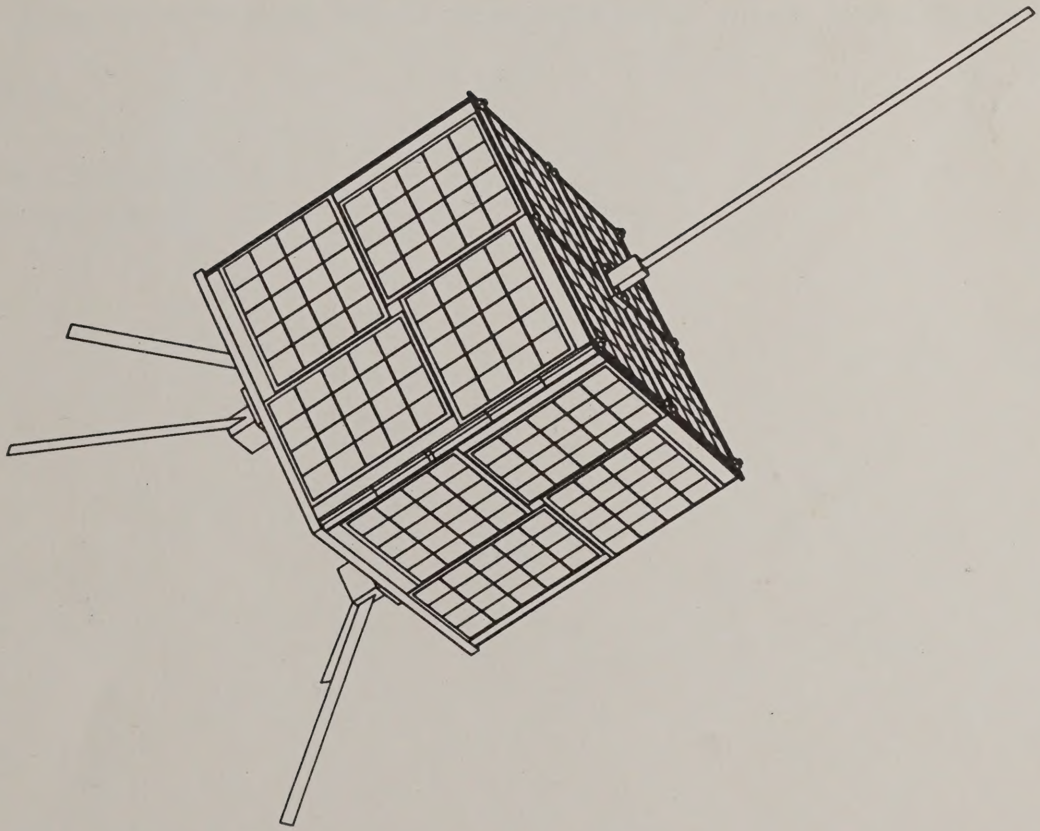
THE
PACSAT
BEGINNER'S
GUIDE



AMSAT'S complete step-by-step instruction guide to operating through the PACSATS. All necessary software is included.

FOREWORD

This is the second revision to this Guide. We have also included our first ever "Elmers" listing of amateurs who are now on the PACSATs and stand ready to help you with any hard spots that this Guide doesn't adequately cover. Additionally this revision contains an Appendix that will carry you on to the 9600 baud PACSATs if you wish. This is now truly a Beginners Guide to the Pacsats — all the way from the 1200 baud birds up into the state of the art 9600 baud ones. Please read the files on the diskette that came with this carefully as they do contain some important revisions to this material.

I only edited this document; many from AMSAT had significant input, most notably Dusty Warner, KF4AU, Courtany Duncan, N5BF, Harold Price, NK6K, Dick Schiller, K4BQH, and Bruce Rahn, WB9ANQ. A special thanks goes to John Kuklinski, N4PLY who was my "Elmer". When you have finished reading it and hopefully putting it to use please take the time to share your comments with me so I may make this a much better tool in the next edition. As you will find out much of the important information in this document is on the diskette that accompanies it. The text will tell you what to do with that diskette and when. For now read the README.1ST file on the diskette to determine any last minute corrections. Please wait until the Guide asks you to use the other files..

Thanks,

Mike Crisler, N4IFD
Dayton, Ohio

JUST WHAT IS AMSAT?

AMSAT is a word you are going to hear a lot when you are involved with amateur satellites. AMSAT is an acronym for the Amateur Radio Satellite Corporation. AMSAT is a non-profit, tax-exempt 501(c)(3), scientific corporation founded in the greater Washington, D.C. area in early 1969. We now have approximately 6500 members and are dedicated to keeping Amateur radio in space!

As you can imagine, building and placing an amateur satellite into orbit is a very expensive proposition, even though a lot of contributions and "low cost rides" are available. AMSAT is the voluntary body that provides this most important and many other supporting functions to the Amateur Satellite Community. The key is that AMSAT is totally voluntary. They don't have a large paid staff. Mostly it is just people like me, and like I hope you will be someday, who volunteer their time and money to support the amateur satellite program. Why all this effort and what does all this gain for us? We gain new and valuable frequency space, totally unaffected by the vagaries of sunspots and the ionosphere, to make those QSOs and file transfers that we find so enjoyable.

Included with this Guide (in the Compendium) is a membership application for AMSAT. Joining this organization will do several things that will help you with your endeavors in the amateur satellite program. First , through its **JOURNAL** AMSAT will bring the latest in operating hints and technical articles right to your shack. As you continue to read this Guide we will frequently refer to articles previously published in this excellent publication. It will be a real help in all of your satellite endeavors. Second, the **JOURNAL** will bring you articles from the designers and builders of these satellite that will help you understand the how and why of their operation. It will also bring you orbital elements and schedules-but by the time you get that first issue you will probably be downloading those off of one of the pacsats!

Probably the most important reason to belong to AMSAT is that about half of the money you send AMSAT is earmarked for new satellite construction. As you begin to use and enjoy the birds that are now up and operating think seriously about becoming a supporter so that hams in the future as well as you and I can continue to enjoy the rare privilege of actually sending a signal into space and getting an answer back!

PACSAT BEGINNER'S GUIDE

Introduction

AMSAT has long had a dream of providing a store and forward satellite for use by the amateur community. In fact this concept was first introduced in the May 1984 issue of "BYTE" magazine. On 22 January 1990 that dream became a reality as six new OSCARs (Orbiting Satellites Carrying Amateur Radio) were placed into orbit by the Ariane V-35 launch vehicle that was launched from Kourou, French Guiana in South America. These "birds" are now for the most part operational and waiting for you to upload a message to another ham anywhere in the world. By the nature of their polar orbits, these satellites will pass over every spot on earth at least four times a day!

My first experience with these powerful mailboxes in the sky came one evening as I was reading the directory of the files that were available on one of the pacsats-AO-16. To my overwhelming surprise, there was a file addressed to me, N4IFD! I downloaded that file and read it when the pass was over. It was a message from a ham in Italy that had received a QSL card from me for an OSCAR-13 QSO and just wanted to say thanks. I quickly composed an answer to my new friend and uploaded it on the next pass. I have since had many messages from "the Continent", in fact from several continents. This Beginner's Guide will lead you step by step through doing just what I've described. It will also introduce you to the many other things the pacsats can do.

JUST WHAT IS A "PACSAT"?

In the opening paragraphs several terms have been used that may not be familiar to you yet. They will be before you are done with this booklet! This Guide will attempt to define and describe each such special term when it is first used. A pacsat is a satellite capable of performing something akin to normal packet radio functions, much as a digipeater or packet bulletin board service (PBBS). The real advantage is that now this digipeater/PBBS is in space and moves continuously so its antenna pattern or footprint covers all the surface area of the earth several times daily. The altitude of a pacsat (like the height of a digipeater's antenna) is over five hundred miles so it can allow me from my Miami, Fl. QTH to digi directly with a ham in California or Canada! Since a pacsat moves so fast this type of QSO can a best last several minutes and with the way most of us type not much information is likely to be exchanged.

What a pacsat does best is take a file or message I have composed or am forwarding from a land based link and then retransmit it to whoever wants to hear it as it makes its way around the earth. Remembering high school geography the earth rotates about its axis once every 24 hours. Once the satellite is in a stable orbit it is for the most part not affected by the earth's rotation. So it just follows its nearly circular orbital track while the earth turns underneath it. As your QTH rotates under this orbital track and the satellite is above your horizon your station can communicate with it. This pleasing state of events happens about six times a day. And interestingly enough these openings occur a roughly the same time each day, making planning for linking to the bird much simpler. This can be described as a sun synchronous satellite. The pacsats while not exactly sun synchronous are very close. Later this Guide will cover tracking these pacsats or simply put knowing when to listen and if you use directional antenna where to point them.

JUST HOW MANY PACSATS ARE THERE?

This is a difficult question to answer in a few words. Most of these satellites are named for the organization that supported their construction, arranged for their launch, and that provides for their long term maintenance and coordination of their use. You may also have heard them referred to as "microsats"; a name given generically to the six satellites referred to above because of their small size in comparison to most spacecraft-The four of most interest to us are only nine inches on a side! But not all six of those satellites are for use by the general amateur population for packet radio file and message handling. The ones that are intended for such use are called generically "pacsats" but their specific names are:

DESIGNATOR	NAME	ORGANIZATION RESPONSIBLE
UO-14#	UoSAT-14	UNIV. OF SURRY, UK
AO-16	PACSAT	AMSAT-NA
DO-17	DOVE	BRAMSAT (Brasil)
WO-18	WEBERSAT	Weber State Univ.
LO-19	LUSAT	AMSAT-ARGENTINA

The following, although not on the same launch, also have digital store and forward capabilities.

FO-20*	FUJI OSCAR 20	AMSAT-JAPAN (JAMSAT)
AO-21*	RUDAK-II	AMSAT-DL (GERMANY)

NOTES:
* AO-21 AND FO-20 have a voice transponder as well as the digital channel. The use of these satellites is described in articles published in the **JOURNAL** and is beyond the scope of this Guide.

# UO-14 is like the other pacsats except that it uplinks/downlinks at 9600 baud. Such a rapid rate of transmission requires some internal mods to your rigs. An appendix to this Guide that will be in the final publication will discuss these modifications for all popular rigs and the operation of this satellite. Though not all that difficult, this is not a satellite for the first time user.

UO-15, which was launched with the other five microsats has malfunctioned in space and is no longer operational.

Two of the microsats launched in January 1990, DO-17 or DOVE and WO-18 or WEBERSAT, are downlink only satellites and will be covered in a separate appendix which will also be in the final version of this Guide. DOVE is also discussed in the Compendium that you received with this Guide

This Guide will concentrate primarily on the use of PACSAT and LUSAT. This Guide will not attempt to cover all possible ways to connect to these pacsats but will cover the main ones in a step by step fashion.

WHAT'S ALL THIS STUFF ABOUT LINKS AND MODES?

Connection to a pacsat or any satellite, requires two things: an uplink and a downlink.

Uplink is the term used to indicate the transmission of data (or voice) up to the satellite. This activity is very similar to "uploading" a file to a PBBS/BBS.

Downlink is the term used to refer to the satellite transmission of data down to the ground station (you). This is also similar to a "download" from a BBS. There is one BIG difference that you must take into account as you set up a station for pacsat operation. Pacsats do this up and down linking at the same time. This is called full duplex.

Full duplex in RF terms; it's much like a telephone conversation as you can talk and hear at the same time. It is very important that as you purchase and set up your station that you keep this in mind so that any possible "crosstalk" or receiver desense caused by our transmitter in our received or downlink signal can be minimized. In packet terms you will have "FULLDUP" set to on.

To allow the satellite to work full duplex two separate bands are used for the uplink and downlink. If you have ever seen the duplexers used on 2 meters and 440 Mhz you know how big they are. You may have even had the opportunity (?) to carry one of these up to an elevated repeater site and know first hand how heavy they are. To make a long story short they are too big and heavy to launch into space. Remember, the "microsats" are only nine inch cubes-no room there for a duplexer. Consequently satellites transmit on one band and receive on a completely different one in full duplex fashion. There is a "hidden" benefit to this type of operation-we eliminate a lot of the "doubling" that is all to common on "simplex" repeaters.

Mode J consist of an uplink on 145 Mhz with a corresponding downlink on 437 Mhz. These frequencies are located in the Satellite Subbands of the 2 meter and 70 centimeters Amateur bands. The combination of these bands is referred to as a "mode". When used on the pacsats this mode is sometimes referred to as Mode JD, with the D indicating digital.(FO-20 and OSCAR-13 have voice (or analog) Mode J transponders aboard them that allow voice QSOs.) When you are selecting the rigs/antennas for your station this is worth remembering as for a few more dollars you may also be able to operate on these transponders. Check the "Frequency Guide" in the Compendium for more details on other modes in the satellite service. As you read the sections concerning the equipment and antennas needed, it will be advantageous for you to review this material and procure the gear that will support operation of the largest number of modes for the depth of your pocketbook.

Another excellent source of ideas and practices that should be followed in setting up a satellite station is AMSAT's "Beginner's Guide to OSCAR-13". I would strongly recommend that as you consider the gear you will be purchasing, look into the possibility of getting gear that will ultimately allow you to work all of the amateur satellites.

WHAT WOULD A SIMPLE PACSAT STATION CONSIST OF?

Generally when most radio amateurs think of satellite stations they envision having to mortgage their home and begin eyeing the kids' college tuition fund. It is not that way. In fact, one of the design goals of the Microsat program was to simplify some of the station requirements. In the following sections I will begin to discuss the basics of transmitting to and receiving from the pacsats with an emphasis on economy and simplicity. This Guide will not cover every possible combination of equipment. Instead I am going to make some personal recommendations of several ways to successfully download and then upload your first file to a pacsat.

In a file called ELMERS.TXT on the diskette that you received with this Guide you will find what may be the most useful part of this Guide-"The Pacsat Elmers List" This is a list of amateurs who are up and running on the pacsats AND are willing to answer your specific questions about the gear and techniques it takes to be successful. The list contains a description of their stations so that you can find an Elmer with gear like you have or intend to acquire and ask those questions that are not covered in this Guide. Please respect their request as far a the time you call these unselfish amateurs.

THE SIMPLE PACSAT STATION

This is a quick description of a simple station; it contains all the basic parts necessary for successful operation. You can make many variations on the component parts without effecting the ability of the station to communicate.

The station consist of: a two meter FM transmitter with a small amplifier capable of about 50 watts; a sensitive receiver capable of SSB on 437 Mhz, a simple dual band vertical antenna (or two independent vertical antennas) such as the J-pole described in the attached **"Getting Started on Amateur Radio Satellites"** Compendium, and a mast mounted preamplifier for 437 Mhz capable of at least 10 dB of gain with a small noise figure. The stuff you don't have, chances are you can build relatively inexpensively. All of this should be connected with Belden 9913 coax or its equivalent to minimize losses.

From the data processing end you will need a MS DOS compatible PC with a modest amount of memory, a TNC that can be used with an external modem, and the external PSK modem (this one specialized piece will be described in detail later). The software you need is on the disk included with this Guide.

The following sections will discuss each of these pieces of gear in detail. Again if your questions are not answered here then refer to the Elmers List.

THE RECEIVER

First let's look at the receiving requirements. The pacsats covered by this Guide (as well as several other amateur satellites) have their output in the 70 centimeter band between 435 and 438 MHz (UO-14, AO-16, WO-18, LO-19 not to mention FO-20, AO-21 and AO-13 mode J/L - see the **"AMATEUR SATELLITE FREQUENCY GUIDE"** in the attached Compendium). Why this higher band and not 2 Meters? Well in many parts of the world 2 meters is very crowded with high power repeaters, packet BBS etc. That makes it somewhat difficult to hear a relatively low powered satellite 500 miles km out in space. On the other hand the 437 megahertz band is very quite even in heavily populated areas.

For receiving sideband from the AO-16 and LO-19 your gear must operate within the 437 mhz portion of the band. Any of the commercially available "all-mode" rigs for 70 centimeters will do nicely. If you have one of these you are in excellent shape for the downlink portion of your pacsat station.

There are also many of these all mode rigs on the used market. Pay particular attention to 435-438 receiving range when shopping for some of the older 70 centimeter rigs. For example, the old KLM ECHO-70 will only cover the bottom portion of 435 MHz. Although there are not a lot of second hand all mode rigs around on 70 cm, a careful review of some of the specialized "ham trader sheets" will turn up several. Review the Elmers List for some ideas on these receivers.

You can expect to pay $1,000 plus for a new all mode base rig. All the major manufacturers provide an excellent selection of such rigs but they are not cheap. Granted, all you need is the receiver, but a receiver such as the ICOM R-7000 is in the same general price range. The following sections will discuss the much less expensive converter route that will utilize your HF rig for receiving the downlink.

One final note, in selection of a receiver, pay particular attention to whether the tuning can be accomplished externally, i.e. by using up/down buttons on the microphone or possibly on the later rigs by a din connector/direct RS-232 input into the back panel of the rig. The available PSK units that will be used for your data acquisition has the ability to tune your 70 centimeter rig and lock on to the satellite's downlink signal and automatically adjust for the Doppler shift throughout the entire pass. They do this by applying voltage pulses to the frequency control input on the up/down pin of your mike connector. This is a very important option to look for and becomes essential if you ever intend to try unattended operation.

CONVERTERS

If you can't afford to purchase transmitter/receiver stand-alone units for 2 meter and 70 centimeters, you might consider building or buying converters for these bands. It's an excellent way to get your feet wet at a relatively low cost. As you can see in the Elmers List there are people using this method quite successfully!

A receive converter simply converts the 70 centimeter signal from the satellite to a 10 meter signal that can be handled by your HF rig. For example, if you were looking for AO-16 which downlinks on 437.025 you might typically tune your 10 mtr rig to 29.025. You don't need a complete transverter which would both transmit and receive on that frequency - just the receiver part. Units are available from places such as Advanced Receiver Research, RadioKit and Hamtronics. Just be sure that you specify to them that you want a receive converter with coverage from 435 to 437.2 so the manufacturer can install the right crystal for the local oscillator in the converter. Another good place to look for equipment sources is the **SATELLITE EXPERIMENTER'S HANDBOOK**.

Caution, make sure you have some positive way of disconnecting the receive converter when using the transmit side of your 10 mtr rig or you will fry your converter (personal observation of smoke here). Either obtain a switch with good isolation or disconnect the coax when you're done. It only took me one nanosecond or so of RF through the converter I had found at a swap meet to "convert" it to junk! BE CAREFUL!

You might also find a transverter (a transverter both receives and transmits) such as a Microwave Modules unit or an SSB Electronics unit for sale second hand. You may have to change the local oscillator frequency to get it up to 437 MHz since such units typically operate at a frequency of 432 MHz. But it's normally just a change of crystal. Keep in mind the frequency you are working with when shopping the hamfests. It's 437 MHz, not 435 or 432. Generally 70 centimeter converters or transverter units will give you 2 MHz of tuneable range in the 70 centimeter band.

If you find a one of these look on the unit to find the conversion or ask the owner what it tunes. Lets say you find one but it tunes 432-434 MHz converting to 28 to 30 MHz. You should be able to change the conversion by changing the local oscillator frequency crystal. Open up the unit and find the crystal. When you have found it look for a number imprinted on it. This number is more than likely the fundamental frequency (not the local oscillator frequency). For example, say it reads 101.000 stamped on the top. If it was designed for 432- 434 MHz / 28-30 MHz operation you're working with a 4X (times four) multiplier chain using 101 MHz as a fundamental.

A simple calculation gives us::

70 cm tune = 432
10 mtr IF = 28 (subtract)
L.O. = 404 MHz crystal (101 x 4 = 404)

Since you want to retune for 437 MHz
70 cm tune =437
10 mtr IF = 28
NEW L.O. = 409 MHz

Since you have a times 4 multiplier divide 409 by 4 = 102.25 MHz for the new fundamental frequency. Now all you have to do is obtain a new crystal cut for 102.25 MHz. In the back of most of the ham radio magazines you find several companies that will cut a single crystal for 15-25 dollars. I have been using Jan Crystal in Florida for several years and they will cut such a crystal for $15. When you complete the installation of the new crystal you may have to retune the tank circuit a bit to get it to start reliably. If you see a trimmer cap or coil near the crystal it is more than likely in the tank circuit. If it won't oscillate try carefully tweaking the trimmers and it will probably start oscillating. If you have a frequency counter put it on the circuit and adjust the components for the right frequency. Then you can peak all the multiplier stages for maximum output using an on the air signal (3rd harmonic of your 2 mtr rig works in a pinch..... 145.666 x 3 = 437 MHz.)

I would also refer you to Ed Krome's (KA9LNV) excellent article entitled "Design of an Easy to Build, Versatile, Homegrown Satellite Ground Station" that covers construction of two converters in detail. This article is available from AMSAT Headquarters.

THE TRANSMITTER

You are probably wondering if you can use your 2 meter FM rig on the uplink? Yes, in most instances you can. Depending on your antenna system modest power levels of 25-50 watts should link you into the bird. If this doesn't work you might try boosting your power with a small amplifier or improving the gain of your antenna system. Remember as always in Amateur radio-USE THE MINIMUM POWER NECESSARY TO MAINTAIN COMMUNICATIONS.

As you select a rig for the uplink you should keep a couple of other things in mind. First, establish whether or not the rig can be set up easily for packet. Some newer units have a separate connector on the back just for data communications, if so, great. You will be imputing an audio stream of data from your TNC into the rig much as the mike inputs your voice. If the rig you intend to use does not have this feature all you have to do is identify which pins on the mike jack are for the audio in and push-to-talk line. You will have to obtain a spare mic connector and cable it to the TNC output. The only disadvantage to this is if you also use your 2 meter rig for voice you will be continually swapping plugs. (If you have a Double throw Double pole switch around you can hard wire up a little toggle control to change back and forth without undoing everything.)

DOPPLER SHIFT-AND HOW IT AFFECTS US

You have probably stood by a railroad track and heard the pitch of the train whistle change as the train approaches and then passes. That change in pitch was very real to our ears even though the frequency of sound coming out of the whistle remained constant. We heard a change in pitch because the source of the sound was moving rapidly toward or away from us. We received and heard a slightly higher frequency (or pitch) as the train came toward us and a slightly lower frequency as the train moved away from us.

The pacsats move a whole lot quicker than a locomotive, even much faster than a speeding bullet. Hence, we encounter an RF frequency shift, called the doppler shift, as the satellite moves away or toward the receiving station in its orbit. It is this doppler shift that causes the need to make corrections to the frequency of the ground station receiver during a pacsat pass. In pacsat operation the doppler shift on the downlink is accommodated by continuously tuning the downlink. The PSK-1 modem's output to the up/down mic buttons does this arduous task for us-hence the reason to pick a receiver with this remote tuning capability.

Corrections would also be necessary to the signal received at the satellite-which could only be made at the transmitter-since it is not possible for each station to remotely tune the VFO of the satellite. Fortunately the brilliance of the designers of the pacsats have taken advantage of some basic RF engineering to all but alleviate any concerns for doppler tuning of that uplink signal.

This is where the deviation of your rig comes into play. FM is by its very nature a wide band mode; the satellites receiver is an FM receiver for that very reason. By adjusting the deviation of the ground station's transmitted signal to between 2.5 and 3.5 Khz (verses the 5 or 6 found on most FM rigs) the "wide bandedness" of the satellite's receiver can adequately receive our now relatively "narrow banded" uplink throughout the whole pass without the need for us to adjust it! Getting this set right on your transmitter is very important. You could have everything else right with your station and this seeming small thing would keep you from uplinking. Either find a friend with the appropriate equipment to help you set the deviation on your rig or consider having a ham radio repair shop to do it for you. Find one of the Elmers with a rig like yours and ask for his advice on this very important subject.

If all else fails ask a friend to listen to your transmitted signal on a 2 meter HT while you turn down the mic gain. When your transmitted audio sounds noticeably quieter than usual you probably have it close enough for some on-the-satellite-trials.

MULTI-BAND RIGS

An excellent alternative to the separate transmitter/receiver route is to acquire one of the multi-band units now available from all of the major equipment manufactures. These rigs , the YAESU FT-736R, the ICOM IC-970, and the KENWOOD TS-790 with the proper modules will work ALL of the satellites as well as be an excellent rig for general operating. If you can afford them they are an excellent way to go.

The original multiband rig, the Yaesu 726, can be found on the used market. With the appropriate modules, this rig will allow you to operate full duplex giving you a 2 meter FM uplink and 437 USB downlink. Again, consult the Elmers list.

ANTENNAS AND TRANSMISSION LINES

In the evolution of the Microsat concept no subject has been more controversial than antennas. Let me say that even as this manuscript goes to print the subject is still under investigation. Having said that, let's look at various types of antennas and see what can be expected both from a theoretical aspect and a practical one. The contributors to this Guide have tried all of the following systems at one time or another.

Assume that you currently have no capability for 70 centimeters or 2 meters. This Guide will start with the simplest system and go forward to the more complex. Your decision in part may be based on your ability with a hacksaw and your willingness to build your own.

For a pacsat station to function it must receive on 70 cm, (specifically 437 mhz) and transmit on 2 meters. So I will discuss the antennas in pairs. The simplest form of antenna is the 1/4 wave vertical both from a standpoint of cost and construction. Since each microsat will give you four passes a day at elevations of 6-60 degrees, this antenna and its low radiation angle will perform best at satellite elevation passes of 10 to 40 degrees. Let's say you can obtain or construct a pair of these antennas. What can you expect? Well, without a preamp on the 70 centimeter side and say 50 feet of RG-8 coax to the antenna, you will at least hear the bird during optimum passes and you may in fact decode some of the packets, but it will be marginal at best. A quarter wave vertical exhibits no gain and you will need substantial gain in your receiving system to adequately decode the downlink from one of the pacsats.

As the satellite goes overhead on a high orbital (about 20% of a pacsats passes are in this class) pass you will notice a definite drop in its signal strength, even though the bird is closer. That's because the signal is now outside the major lobe of the 1/4 wave vertical antenna. In theory, the relative proximity of the bird should compensate for this but in a marginal system it simply doesn't. Don't despair, as there are still a lot of lower passes that will allow you to use your simple vertical effectively-if you use a good preamp and low loss feedline.

The next easiest improvement for many and in fact what most satellite operators consider mandatory is the addition of a receive preamplifier at the base of the antenna. This option can net you 10 to 20 dB of gain.(I will discuss preamplifiers in more detail later). Unless you already have a 70 centimeter beam of some kind a vertical with a preamp is the recommended place to start.

A simple 1/4 wave vertical antenna can be modified in several ways to obtain more gain. It could be changed to a 5/8 wave or to one of the collinear type verticals, such as Cushcraft's Ringo Ranger or AEA's Isopole to increase gain even more. But just remember as the gain of an antenna increases it looses its ability to be omnidirectional. Nothing is for free in this world. But by all means if you already have one of these type antennas give it a try; only then will you know what you can hear and decode with your system. A preamp is still mandatory with these antennas for acceptable performance.

An excellent article on the construction of a dual band J-Pole vertical antenna that was designed around the Microsat project appeared in the March 1990 Issue of **The AMSAT Journal**. This antenna coupled with a modest preamp will give you satisfactory performance. It is easy to build and the cost for the materials is very minimal. If you don't have a suitable antenna for either 437 or the 145 uplink my recommendation is to start by building one of the dual band J-poles. Then as you acquire a better antenna for one of the bands you can just use half of the J-pole! If nothing else read the article on its construction as it contains some extremely valuable information on the microsats. This article in its entirety is reprinted in the Compendium you received with this Guide.

The main disadvantage of the vertical antennas is that reception falls off sharply at higher elevation angles. Additionally the more the antenna gain is increased the deeper this null becomes. The second major disadvantage is that the vertical antenna has a linear polarization sense.

For those of you experienced with satellite reception, you will remember that the sense of the transmitted wave form from a satellite is circularly polarized. Knowing that, deep signal fades at the groundstation can be expected as the satellite's circular wave front precesses around the ground stations simple linear-vertical or horizontal- antennas. To be most effective a ground station's antenna system must also be circularly polarized.

For a more complete discussion of polarization sense, refer to Chapters 7 and 8 in the recently revised version (dated 1990) of

SATELLITE EXPERIMENTER'S HANDBOOK. Make sure you purchase the recent revision of this marvelous work as it has been totally rewritten specifically for someone with limited knowledge. You can read the **SATELLITE EXPERIMENTER'S HANDBOOK** and understand a tremendous amount of material about the whole spectrum of amateur satellites. AMSAT sells this book; you can also use the membership blank that came with this package to order this excellent reference.

Both the Lindenblad and Turnstile antenna attempt to deal with these circularity problem and are described along with construction details in the **SATELLITE EXPERIMENTER'S HANDBOOK.** These antennas are easy to homebrew and are a better unit for your station than a vertical.

BEAM ANTENNAS

I received a letter from a ham in the UK who is using his linearly polarized beam antenna manually elevated to 20 degrees and fixed to the east. He says he gets "pretty good reception". For those of you who have used AO-10 and AO-13, undoubtedly you have some type of high gain antenna array. Of course, they will provide excellent results when used on the microsats. The main disadvantage the high gain Oscar-10/13 arrays is that they are not Omnidirectional. In other words this requires that you point the antenna array (both azimuth and elevation) at the bird throughout the pass. This can be daunting with a narrow beamwidth, high gain array during a high elevation pass of a fast moving pacsat! Even more so if you have to try to type any commands into your PC! Thankfully this process can be automated by computer. Most of the Az/EL rotors on the market will interface with your computer and the appropriate interface card. AMSAT's top of the line tracking programs have the antenna steering program incorporated in them. With a good set of orbital elements and accurate clock settings, the process becomes automatic.

If you have standard beams used for FM or SSB they will work for the pacsats with excellent results. If you do not have an elevation rotor try what the Englishman did-elevate them about 20 degrees or so and have at it. You won't have lost much in your terrestrial operation and your pacsat operation will be satisfactory.

As always, each system has its advantages and disadvantages. I have found that a 5/8 wave with a good preamp and low loss coax can provide a good system requiring minimal expense. Again carefully study the Elmers list and give whatever antenna system you come up with a try!

Several excellent publications on antennas for VHF/UHF and Satellite are in print. Examples are ARRL Handbook, The ARRL

Antenna Book, The Satellite Experimenter's Handbook, and RSGB VHF/UHF Handbook.

TRANSMISSION LINES

Whichever route you choose, please pay particular attention to the transmission lines. At VHF/UHF frequencies the loss associated with feedlines becomes very important. For example, at 437 mhz a 100 foot length of RG-58 coax exhibits a loss of more than 5 dB. What this means is that between the time the signal leaves your antenna and arrives at the receiver, it has lost more than two thirds of its signal strength. On a marginal system, this can mean that the signal will not appear much above the noise-or more than likely not appear at all. For short runs (under 25 feet), RG-8/RG-213 may be adequate. Much over that distance, I strongly recommend a low loss cable such as Belden 9913. Over 100 feet, you should really consider hardline for your 70 centimeter antenna and perhaps 9913 for 2 meters.

Additionally pay particular attention to your connector terminations. UHF (PL-259s) type connectors may be okay at 2 meters, but at 70 centimeters, only "N" type connectors should be used. Most N-type connectors available at swap meets will not fit on 9913. There is an Amphenol connector (#82-202-1006) with a large center pin made for 9913. It is available along with Belden 9913 from Nemal Electronics, Inc., 12240 N.E. 14th Ave., North Miami, Florida 33161, (305) 893-3924. Certified Communications (see their add in QST) also has these connectors.

I would encourage you to use type-N fittings on your coaxial cable whenever possible. These connectors have very low loss and are very reliable. If you end up with a piece of gear with the standard SO239 or PL259, consider changing these to type N connectors, they perform much better for satellite usage. In some cases you can specify the type of connector when ordering gear. If you can specify type N.

Due to the construction of the N-type connector, the coax is held in place mechanically by the shield, rather than being soldered to the connector body as with the PL-259. Since 9913 has a foil shield with only a small amount of braid, the connector can support only a small amount of stress. I would strongly suggest some form of "stress relief" to prevent the weight of the cable from being supported by the connector (as at the drop from the bottom of your antenna). Heavy duty heat shrink tubing, overlapping both the connector and the cable by several inches, is one effective method of accomplishing this. In any case, 9913 is worth the effort.

Please pay close attention to weather-proofing your connectors and feedline system. Moisture intrusion into coax and associated connectors will quickly degrade the performance of your carefully planned system. I use heat-shrink tubing or good electrical tape sprayed with clear Krylon over all my fittings. Also, the type-N connectors greatly reduces the possibility of water intrusion. Some hams use silicon type RTV sealant to assist in the waterproofing of their stuff. USE CAUTION HERE! If the "right" kind of silicone/RTV ISN'T used, more damage can be done in the long run than good. You must use a non-corrosive silicon/RTV. Most silicon and RTV sealants have acetic acid in them. That's why they smell like vinegar when uncured (wet). Do you intentionally want to use acid on your connectors and sensitive electronic gear? I don't! The run-of-the-mill stuff you get at your local hardware store IS going to be the corrosive type. Sniff it next time and note the vinegar like smell (no you won't get busted for sniffing this type of "glue").

The non-corrosive type is the only type which should be used. Dow Corning 3145 RTV adhesive/sealant IS a non-corrosive type and the only one I use on my electronic stuff. (I don't own Dow stock. I just don't know who else makes non-corrosive RTV.) It is worth the extra effort to find this stuff.

Take your time and assemble these N-type connectors "perfectly," accept nothing less. The ARRL handbook has excellent instructions on how to assembly these connectors. Most experienced UHF/VHF operators will attest to the importance of this step. Nothing is more aggravating than to find after a hard rain that the "N" connector on you 70 centimeter vertical mounted at 60 feet on the tower has managed to fill with water. Wrap the connection with a good grade of electrical tape as a minimum. Seal it with a spray sealer such as Clear Krylon. Let it dry and repeat the process. Once that's done, coat the entire surface with a coat of silicone/ RTV. Another option is to use one of the high grades of thick walled heat shrink tubing to weatherproof and strengthen these connections.

PREAMPLIFIERS, FILTERS, AND AMPLIFIERS

Possibly the most important piece of any satellite receiving station is the pre-amplifier. Pre-amplifier technology has advanced tremendously in the very recent past. New generation GaAsFET pre-amplifiers are capable of exceptional gains of 20 to 24 dB with almost no added noise (noise figure approximately .5 to 1 dB). In weak signal work, preamplifiers are a fact of life. Essentially it amplifies the incoming receive signal prior to its entry into the feedline or receiver. If your station incorporates some type of omnidirectional antenna, you will probably find the use of some type of preamp essential.

Normally you will find two types: the more common inline receive only preamps and the ones that incorporate some type of RF sensing relay scheme that switches the preamp out of the circuit so you can transmit into the antenna. If you are going to use the 70 centimeter antenna exclusively for receive, then you can use just the straight inline version. If you are going to use your antenna to transmit, you must either acquire a switchable type preamp or build some relays and a sequencer.

There are a couple of options to consider.

1. Mast mount GaAsFET

2. GaAsFET in the shack

If you have more than 25 feet of feed line at 70 cm, you should consider mounting the preamp right at the antenna. Coaxial line and connectors not only add loss, but also will produce a certain amount of white noise at 70 cm. To overcome this phenomena, mount the preamp on a short piece of good coax right at the antenna or at the first connector location near the antenna. By doing this, there will be a larger signal to noise ratio and you won't be amplifying noise. Some preamps are made in a weatherproof housing (such as ICOM, Lanwher, SSB, Advanced Receiver Research, Etc) while others are not. The **SATELLITE EXPERIMENTER'S HANDBOOK** has a very complete list of these items-both in kit form and ready made.

I would recommend you carefully review the specifications of all the manufacturers and pick out one that maximizes the gain, minimizes the noise, and still meets your requirements. When I say meets your requirements, one of the things that must be considered is how the pre-amplifier you have selected passes transmitted RF. I have room for only one set beams, and must use them for local FM repeater work, sideband work, and satellite communication as well. Consequently I sometimes want to transmit relatively high RF power through these beams. For this purpose I chose a pre-amplifier that was designed to pass a large amount of power, but still offered high gain-and most important low noise figures. Such preamps can pass 160 watts, which is all you will ever need.

If you never intend to use your antenna for transmitting, preamps are available from the same manufacturers that cannot pass RF but are less expensive. However, if by chance you do transmit through these preamps, you will ruin them.

The pre-amplifier needs to be mounted as close to the antennas as possible. I mount mine on the vertical mast that holds the elevation rotor, just below that rotor. (If you are using a vertical mount it on the mast just below the antenna.) Consequently I have a short drop of coaxial cable from the circularly polarized downlink antenna to the pre-amplifier. I have found that this works exceptionally well. Use some of the more flexible low loss coax here like Certified Communications' Flexi-

4XL (a 9913 clone that is very flexible).

Check in the **SATELLITE EXPERIMENTER'S HANDBOOK** for sources of preamps; a lot of very good ones are available as kits. Before you buy make sure to also carefully review the Elmers list.

TNCs/PSKs/DSPs and other auxiliary boxes

A pacsat station must have a terminal node controller (TNC) to convert the digital information coming from the computer to audio information for the transmitter and receiver. Some of you may now be operating on "regular" packet. If you are, you're already familiar with much of what I will discuss here. All of the microsats are "digital birds" so to speak. None have analog transponders as FO-20 or AO-13 have. A TNC with the proper modem will allow your computer and radio to converse with the computer aboard the satellite.

Most TNCs will interface with your transmitter / receiver fairly easily. Some of the newer radios have a separate port called the "data" connector. It makes interfacing everything much easier. You will have to make several changes from the standard packet setup on your hookup since your station will be operating full duplex / split band. You will also have to add an outboard modem to the scheme and I'll discuss that in more detail. A caveat before you begin the wiring... pay attention to the cable construction. Build each one as though your life depended on it. This thing is complicated enough without having to run down a poor solder joint or a set of touching wires inside a sealed up din plug. A short in this hookup can cause the TNC to do some really strange stuff!

First lets look at the TNC (terminal node controller). If you don't yet have one there are a couple of things to look for. Make sure the unit will operate in the KISS mode, all TNC manufactured since 1986 include this protocol (More about KISS later). However some of the older TNC 2s and TNC 1s did not have the KISS software incorporated in the EPROM that's inside the TNC. But, many can be modified to run kiss. On a MFJ 1270B all I had to do was change the EPROM and even an old Heathkit HD-4040 TNC-1 only required a little rewiring, a switch and a new EPROM from TAPR (Tucson Amateur Packet Radio Corp).

Follow the manufacturers directions in setting up the TNC and use it for a while on terrestrial operations with a BBS or a friend until you become familiar with it before you attempt to interface it into your satellite station. (That way you will know it was working BEFORE.....).

The "connected" mode of the AX.25 protocol is used to upload and download files from the pacsat. In addition, a special broadcast protocol can also be used to just receive files. The advantage of the broadcast protocol is that many ground stations can simultaneously receive a file, rather than each one of them connecting to the pacsat and requesting an individual copy of the file.

This broadcast protocol uses AX.25 "unconnected mode" frames. The program used to implement the broadcast protocol, called "PB", uses the KISS option in the TNC to receive these frames.

When you use the software written by the AMSAT team such as is included with this Guide, you don't have to do anything to turn on "KISS" - your software will do it automatically and shut it off when you exit. Just make sure the TNC you will be using has that flexibility.

A second thing to must look for in a TNC is the ability to interface a different modem other than its onboard modem. The onboard modem in a normal TNC uses AFSK (audio frequency shift keying). The pacsats use a phase shift keying technique. A pacsats' downlink is PSK in USB and the FM uplink when modulated by the PSK Modem is called Manchester APSK.

This change to PSK was made only after a lot of consideration and for extremely valid reasons. PSK can be decoded at much lower signal to noise levels than AFSK or FSK can. To give you an example, when I was testing the TAPR PSK unit that I built I used an audio tape that had recorded PSK signals on it. I set the level as weak as I could and didn't think it had a chance of decoding but it did. Many times the signal has been right down in the noise and it still clicked right along. That kind of performance is just not there in AFSK.

To take advantage of this PSK you will need to disconnect your TNC's onboard modem and interface the outboard PSK unit to the TNC. This is not as hard as it sounds. All the help you will need can either be found in the excellent docs that come with the units or from one of AMSAT's dedicated Elmers.

As for the PSK unit itself you have several options at this point. A complete unit ready to run is available from PacComm in Tampa, Fl. for $ 249.95. This is an excellent unit, basically an improved commercially built version of the TAPR kit unit. It comes with a very informative instruction booklet that gives step by step details of how to interface this rig with many different radios and TNCs. PacComm is also very helpful if you have problems making your components communicate correctly.

The G3RUH modem from RadioKIT in New Hampshire is also an excellent unit. Look in a late issue of QST or in the **SATELLITE EXPERIMENTER'S HANDBOOK** for the name and address of this organization. They also have a lot of other equipment that can help you-ask for a catalog.

The TAPR kit is available for $125. It is also a great value! But, I repeat BUT it is not simple to build or test. You must have access to some test equipment. If you have never built a kit before you may find it very difficult. Troubleshooting skills may become necessary. In the March, 1990 issue of **The AMSAT Journal** is a very good article by Jim White, WD0E, on the construction of the TAPR PSK modem.

Regardless of which way you go you will have to interface your PSK unit with
1. your computer
2. Your TNC
3. Your VHF transmitter
4. Your UHF receiver

Use a full RS 232 cable to the computer from your TNC (The software called PG needs it). The modem disconnect header will provide part of the wiring to your TNC along with a simple DIN cord you can buy or build. The VHF radio will require full transmit and receive cabling if you are also going to use your unit for standard 2 mtr packet. Your UHF unit will require receive cabling along with AFC (automatic frequency control) cabling. A switch on the front panel will provide you with control over 2 mtr AFSK and split 2 meter/70 centimeter split operation. If your radio has the ability to remotely change frequency (with the mic clicks) you can use the AFC from the PSK unit. As discussed previously in dealing with the reception of any satellite the Doppler Shift of the downlink must be considered. In simple terms the satellite downlink frequency in any given pass will appear to drift. It will start out high, as it passes your location be right on very briefly and as it goes away it will appear lower and lower. With the Microsats this shift is about 15-20 KHZ in a 10 to 15 minute period that constitutes a pass. For example AO-16 shows up around 437.035 and disappears around 437.017 for most locations.

PACSAT caries two transmitters: one regular and one raised cosine. When tuning for a lock on the normal transmitter (usually every day but Wednesday UTC) you may get a carrier lock on a "harmonic" rather than the true signal. If no data starts coming through in 10 or so seconds try retuning.

The other transmitter is called the "Raised Cosine" downlink. Don't get hung up on the description of this. This is simply an experimental transmitter that has attempted to suppress some of the harmonics that will frequently be strong enough to capture your PSK modem and hence lock the receivers VFO on that "dataless" signal. Through electronic wizardry these harmonics have been suppressed about 10 to 15 dB more in the raised cosine downlink. But as always at some cost-the overall downlink signal is at a lower power level. Try to keep a record as you become proficient at the operation of the pacsats and record if this raised cosine beacon is really easier to lock onto the signal containing data.

TRACKING-OR IF YOU CAN'T FIND IT YOU CAN'T WORK IT!

Well, "you sure can't hear them, if you can't find them," I guess is one of the new maxims of amateur radio in the era of amateur radio satellites. Knowing where to point your beams or when to listen for a pacsat can sometimes be a bit tricky, unless you have the right equipment. The best way to perform this tracking function is the computer method. Since you probably have a personal computer (packet is REAL hard without one), AMSAT can provide you with an excellent software program which gives you precise details on when to listen and where to point your antennas. A listing of these is in the Compendium that came with this Guide. Even if you are using a vertical you will need to know when the satellite comes up and goes down.

Before the program that you purchase from AMSAT will work it will need a current set of orbital elements.

Orbital elements are the set of parameters that describe the orbit for the specific satellite in terms that the computer can understand. They are available several places such as in **The AMSAT Journal**, usually on the ARRL's information broadcast from W1AW, on the AMSAT nets, and probably on a packet bulletin board that you can access and, of course, on the pacsats. To assure accurate predictions for the pacsats the element set should be no older than a couple of months. Updating them every week is not necessary, however. When running the printouts, since pacsat move relatively rapidly, I find that one data point every minute is enough.

In the discussion above I stressed buying this program from AMSAT. There is a very important reason for this that I hope you will try to understand and embrace. AMSAT derives much of its income from its sale of software. This is the same income that funded some of these pacsats-No software sales equals no satellites! So please buy a copy of the program of your choice from AMSAT-you can use the attached order form-and resist giving it to you friends.

If you catch them doing that please explain to them that what they are doing is bad for amateur radio and ask them to refrain from same.

SOFTWARE

The software suite on the included diskette contains all the software needed to work the pacsats. The disk is set up to auto load on to the hard disk of your PC. BEFORE YOU DO ANYTHING MAKE A BACKUP DISKETTE. Also please thoroughly read the README file on the diskette as it contains explicit information on how to load the software on your PC.

After you use these programs for a while I am sure you will find a better way to configure you PC. But for now just do it the way that is discussed in this Guide so you can get started quickly. What I have done in these subdirectories is to configure the software programs in the fashion currently recommended by the Microsat command team and set up some very simple subdirectories to help keep the satellites straight.

The diskette will set up and partially fill the following subdirectories:

AO16
LO19
PACDOC
ZIP
DOWNLOAD

The diskette may also have on it a file called ORBS.XXX which are the orbital elements that can be autoloaded into the software you are going to buy from AMSAT! These orbital elements were downloaded off of the satellite-your next source of info on the amateur satellite program! (Hint:Look in the .DL files for this file.)

One of the files located in each of the two satellite subdirectories is called "pg.cfg" and looks like this for AO-16:

```
ao16access 30660
bdcstcall pacsat-11
bbscall pacsat-12
mycall N4IFD-0
port 1
speed 9600
graball 1
log_kiss 1
log 1
maxdupes 10
restart_delay 54
break_delay 36
maxsel 30
```

You need do a couple of things to this file before you try to run the rest of the programs. First-put your call in place of mine, Next- check that you TNC is capable of communicating with your PC at a speed of 9600 baud. If not change that line accordingly (it needs to be 2400 or higher). Finally- change the "port 1" as appropriate for you PC's serial port. Make these same changes in the similar file in the LO19 subdirectory.   You are ready to copy your first pass on AO-16.

You have no doubt noticed that the subdirectory for LO-19 contains ONLY the PG.CFG file that is specific to LUSAT. This was to save disk space on the distribution diskette. Please copy all the other files (except PG.CFG) from the AO-16 subdirectory into the LO19 subdirectory. It will then be ready to copy the downlink from LUSAT!

As you begin to run these programs other files will be created and placed appropriately in these subdirectories.

The present release of the PACSAT Groundstation Software consists of four programs which implement the PACSAT protocol suite described in a paper by Harold Price, NK6K and Jeff Ward, G0/K8KA in the 9TH ARRL Computer Networking Conference Proceedings. These protocols and programs introduce a new type of "BBS" operation to amateur packet radio. In standard BBS operation, you connect to the PBBS station and are treated like a remote terminal user. In the PACSAT system, however, your computer connects to the satellite's computer and the two exchange messages efficiently using automated procedures.

This automated approach requires standardization of procedures and data formats. The protocol specifications - collectively called the PACSAT Protocol Suite - specify a standard file header format, a broadcast protocol, and a connected-mode file-transfer protocol. This file-transfer protocol is referred to as "FTL0".

The ground station software was written by Jeff Ward, G0/K8KA, at the University of Surrey in England. It includes the following programs:

PB.EXE - Receives broadcasts from PACSAT. After you have received a broadcast file, you must process it with PHS.EXE to put it in a format that you can read easily.

PHS.EXE - Displays PACSAT File headers, and removes headers from files which have been downloaded from PACSAT. PHS.EXE is the complimentary program to PFHADD.EXE. These headers are attached to the files to facilitate a pacsat's handling of the files.

PFHADD.EXE - prepares files for uploading. Only files which have been processed by PFHADD.EXE may be uploaded to PACSAT.

PG.EXE - implements the connected-mode file transfer protocol called FTL0. PG.EXE can be used to obtain lists of files which are on PACSAT, to download files from PACSAT, and to upload files to PACSAT. Before uploading a file to PACSAT, you must prepare it with PFHADD.EXE. After downloading a file from PACSAT, you must process it with PHS.EXE.

Do your best to keep up with changing versions of these programs. Some new versions will be bug fixes and some will contain enhancements. While it remains practical, the newest versions of these programs will be available on the satellite. If it is a while before you actually have a chance to try these on the satellite, check with the AMSAT Headquarters for the latest revision of the PB/PG software suite. For a small donation the latest software will always be available there.

There are several executable files in these subdirectories that need explanation before you run them. **Be aware some of these programs (PG & PB) will not run unless you PC is connected to the PSK1/TNC and they are powered up!**

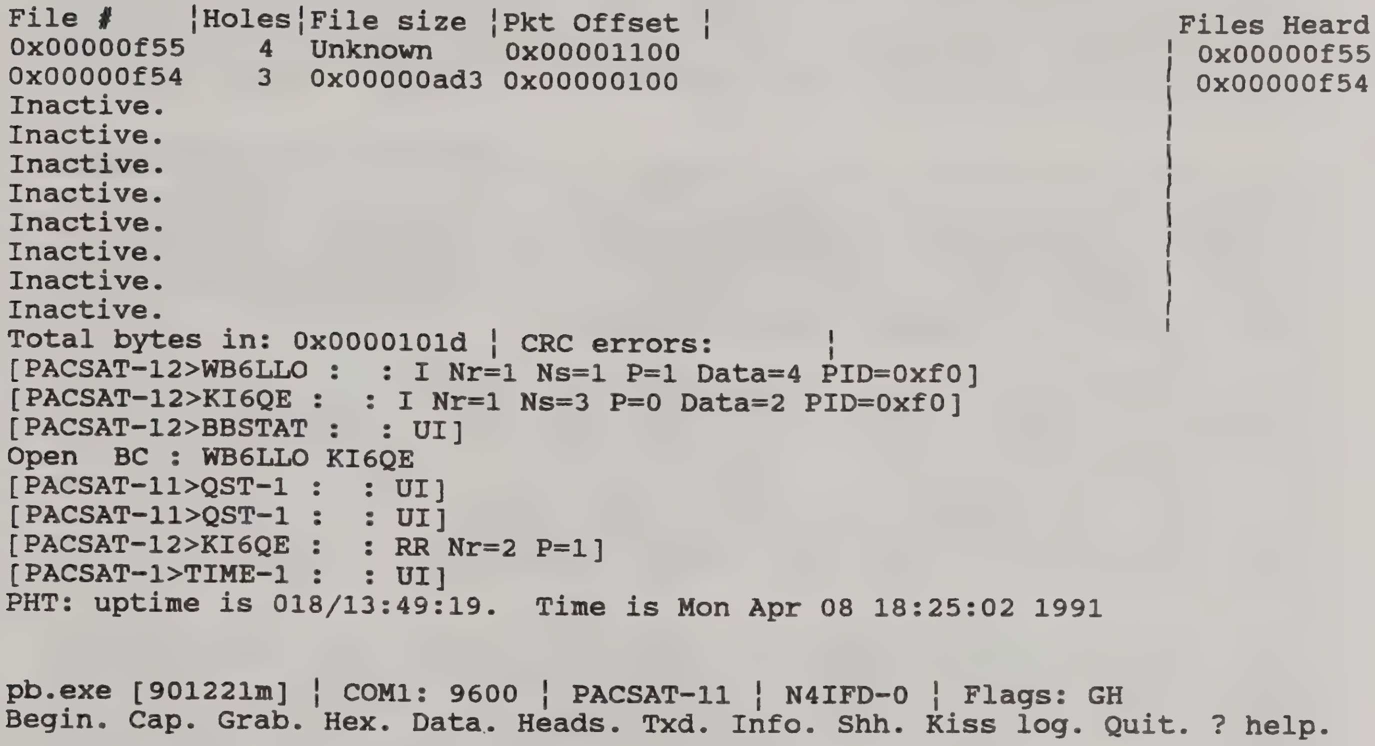
The program I would suggest you run first is PB. Change into the AO16 subdirectory and type " PB" followed by a return.

The PC should begin to scroll many messages across the screen and wind up with a nice screen that looks like the one on page 23. If it doesn't most likely there is a communication problem with the TNC or PSK. Recheck all your cabling -try the TNC on a local packet BBS and determine if that part of your system is operational. Next, carefully reread the instruction books before as a last resort you call on one of the Elmers.

PB is the program you will use to tune in the satellite and just copy what ever file it is broadcasting on the downlink. It requires less time to get up and running with this program because it doesn't even know or care if your transmitter exist.

After you have the screen like the example on page 23 up on your PC press the letter H and D to tell the program to display all the file headers as they are broadcast along with the data being broadcast. The display of these headers/data is the most certain way to tune in the right part of the downlink signal. Make sure the "H" and "D" on the bottom line of the screen are on! You will note that the G and K commands have already been invoked by the software setup commands. The G or Grab command is the one of interest as it lets you capture all the files being broadcast by the satellite. Then all you need do is tune in the downlink as the satellite comes up and goes by.

Tuning can sometimes be a bit tricky. I find it works best when my downlink receiver is on USB and I have set the audio just a little higher than a quarter up from off. (Too much audio will cause difficulty with the PSK's tuning-if it uses speaker output audio versus some fixed level audio output.) Start tuning well above where you expect the satellite to be-for instance about 437.037 for AO-16 and slowly tune down toward the published downlink frequency of 437.025. Keep going back and forth like this until you hear the downlink. This process is much less time consuming if you have current elements in your tracking program and are using an accurate time source in your shack. About the time the program says the satellite will rise you should begin to hear the soon to be familiar sound of PSK. Keep tuning above where you first hear this sound and slowly tune down on it while watching the display LEDs on the front of the PSK modem. It will indicate "lock" as the PSK modem locks on to the PSK downlink. At this point you probably will not see anything beginning to scroll across your screen, You have probably locked onto one of the vestal sidelobes of this signal. Keep tuning slowly on down until you acquire the next lock-this should be the one and momentarily the headers being



```
File #     ¦Holes¦File size ¦Pkt Offset ¦                                    Files Heard
0x00000f55    4  Unknown     0x00001100                                     ¦ 0x00000f55
0x00000f54    3  0x00000ad3 0x00000100                                      ¦ 0x00000f54
Inactive.                                                                   ¦
Inactive.                                                                   ¦
Inactive.                                                                   ¦
Inactive.                                                                   ¦
Inactive.                                                                   ¦
Inactive.                                                                   ¦
Inactive.                                                                   ¦
Inactive.                                                                   ¦
Total bytes in: 0x0000101d ¦ CRC errors:       ¦
[PACSAT-12>WB6LLO :  : I Nr=1 Ns=1 P=1 Data=4 PID=0xf0]
[PACSAT-12>KI6QE :  : I Nr=1 Ns=3 P=0 Data=2 PID=0xf0]
[PACSAT-12>BBSTAT :  : UI]
Open  BC : WB6LLO KI6QE
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>QST-1 :  : UI]
[PACSAT-12>KI6QE :  : RR Nr=2 P=1]
[PACSAT-1>TIME-1 :  : UI]
PHT: uptime is 018/13:49:19.  Time is Mon Apr 08 18:25:02 1991


pb.exe [901221m] ¦ COM1: 9600 ¦ PACSAT-11 ¦ N4IFD-0 ¦ Flags: GH
Begin. Cap. Grab. Hex. Data. Heads. Txd. Info. Shh. Kiss log. Quit. ? help.
```

broadcast by the pacsat will start to fill the lower half of the screen. this sometimes takes 10 or 15 seconds so be patient! If this doesn't work right the first time don't give up just keep tuning slowly from above the signal until you acquire lock and data begins to scroll across the screen. You may tune through several locks before you get locked onto the signal with the data stream. Be patient, you will get much better at "hearing" which is the right signal in a short time.

Another way to check this is as the tuning LEDs on the PSK illuminate and move toward the center indicating that the PSK signal is locked watch the "CON" light on the front of the TNC. When it first flashes you are exactly in the right spot-let go of the VFO! Simultaneously data and headers will begin to scroll down your screen! You are locked onto the center of the downlink; take your hand off of the VFO and the PSK modem will take over the tuning chores while you just sit back and watch the files come down and the headers go by.

The only problem that you must watch for is if the bird takes a deep fade (20 dB or so) the downlink may unlock causing loss of data. If you don't retune manually the PSK will just kind of twiddle around the last frequency while the bird goes south on you. If this happens, go back to basics-quickly tune above the signal and look for the signal containing data.

As the files begin to come down the upper right hand part of your PB screen will begin to fill up with the hex file names of the files being put into the broadcast mode by the satellite's CPU. In the upper center portion of the screen the number of holes in the file will be tracked while the lower portion of the screen will basically perform like your packet screen does when you have MON set to ON.

When the pass is over you then will be able to read what you have gotten off the pacsat. As you ask the PB program to"Quit" it will write something called hole files to the disk. These tell it what partial files it captured during this pass so it will only look for fills on those files next time around. The files that are successfully downloaded will be stored as a hexadecimal number followed by the extender "dl" indicating they are complete downloaded files. Usually your PC will beep during PB operation indicating it has completed the download of a file and the bottom line of the screen wiLl say **"YO FILE XXX IS COMPLETE."** These files can then be read by using another one of the programs on the diskette, the Pacsat Header Show routine or PHS.EXE. I have included some .dl files on the diskette for practice with PHS.EXE. Some of these files are actual programs that will help you with your pacsat operation. Take some time and unlock each of them.

I make a copy of all the .DL files after each pass in a separate subdirectory in order to keep them as sort of a history file. I then move them out of the satellite subdirectory to a "Read" subdirectory where I can extract them with PHS and read them.

Frequently these files are Zipped and you will need PKUNZIP to open them up. I have put it along with all the ZIP shareware programs on the diskette that came with this Guide. Some of the .DL files I have given you are zipped. Run them through PHS and read them. This will give you the opportunity to practice using the .ZIP protocol with some of these files.

Work on becoming good monitoring the pacsats with PB before you attempt to involve your transmitter/uplink system. As with all Amateur satellite communications-work on your receive station and perfect it before you begin to transmit. Don't hesitate to contact me or one of the listed Elmer's if you can't get PB to work. Chances are we had some of the same difficulties.

GOOD OPERATING PRACTICES

Amateur radio can not prosper without all amateurs understanding what "good operating practices" are and using them continuously. Using amateur satellites is no different; in fact is more important that you understand these as they apply to the satellites and always operate in the correct manner. Before this Guide takes you any further and certainly before you begin any transmitting up to a pacsat the following should be thoroughly familiar to you.

The first good practice that comes to mind is the oldest one around--LISTEN BEFORE YOU TRANSMIT! This applies just as much to satellite and microsat operations as it does to any other facet of amateur radio operations. Since I cannot " listen to the noise packet radio makes and tell what is happening I must rely on what my PC is telling me as it decodes the packets. Here is what you should do BEFORE you hit the "B" key in the PB program and before you do anything in the PG program.

After you have the satellite's downlink locked in and are getting text on your screen check for the following:

a) Is the PBBS in operations? Monitor and look for the BBSTAT (Bulletin Board STATus line). Is it there? If not, the BBS isn't running and trying to "work" it will cause needless QRM. If is there it will look something like this:

PACSAT-12>BBSTAT:Open -This indicates all 4 (A-D) uplink channels are open waiting for someone in PG to make a request

PACSAT-12>BBSTAT:FULL KG4TM KB9CML VE1HD WB9ANQ or something similar would indicate it was full-wait before using PG for a request-you can use the "B"-Begin file download command in PB at this time however as that is a separate function of the pacsat.

b) If the you don't see the BBSTAT (bulletin board status) line, please look for the LSTAT (link status) line. IF the LSTAT line indicates d:0 then the digipeater is out of service-DON"T TRANSMIT If d:1 then all is well you may transmit if the pacsat is not otherwise busy. Does it start with an "A"? If so, the BBS and digipeater are not available as code uploading is in progress. Users should NEVER transmit when uploading is in progress. These will look something like this on your screen:

A: 0x14C9, P:0x3000/ o:0 1:8700 f:8711 d:0 st:3 the **d:0** is the key on this line that indicated that the digipeater and the PBBS are not available-so don't transmit!

c) Check the plain ASCII text frame (>AMSAT for example). Command stations will usually post a brief message here saying what's going on with the satellite --like reloading code, everything's ok so use me, I'm switching to the raised cosine transmitter tomorrow, etc. This might look like:

File system is being loaded at this time. BBS should start soon 73 de AMARG This is an actual message from LUSAT during a reload.

d) Don't see any of the above but hear a signal? The bird is in MBL(the base or command mode) mode. Don't even think about transmitting--she's broken! the headers in a state like this would look something like this

PACSAT-12:MBL
PACSAT-12:MBL if it looks like this don't transmit; someone is trying to fix the pacsat.

USING PB TO REQUEST FILES

After you can copy the downlink reliably the next step is to complete the hookup and deviation set-up of the transmitter. I would suggest the first way to try your uplink system is to invoke the "B" command of PB. The PB screen will indicate under the "Files Heard" column several file names in Hexadecimal representation. Pick on of these say e92 and ask the pacsat to put that file in its "broadcast" mode. You do this by depressing the "B" key, the program will then ask in what size packets you would like to receive this file-answer by keying in 128 and hitting return. Your transmitter will now key up briefly and ask the pacsat to place this file in the broadcast rotation. The channel you would use to request this bulletin will be discussed shortly.

There will be no acknowledgement back to your station of the satellites reception of this request other than a confirmation that will be broadcast on the downlink. An example of this is shown on page 28. This page is a "screen print" from my PC. My experience is that I don't always see the small "OK" on the downlink; even though I will usually start to see the file I ask for begin broadcasting within a few seconds. You can tell which file is broadcasting when its designator is highlighted.

In the previous text the term "PACSAT-12" was used; the screen print has the term "PACSAT-11" instead. the -11 indicates activity by the broadcast side of the pacsat while the -12 indicates activity by the PBBS side. You might also have noticed that both designators are in the PG.CFG file. To digipeate through the pacsat you would use the -11.

Pacsats are actually built to be "two" satellites in one. One part of the satellite continuously broadcast selected files and is available for digipeating while the other is dedicated to the PBBS functions. There are not really two satellites as these two functions share the four uplink channels and the one downlink channel.

Recommended Operation Procedure to Reduce AO-16 Uplink Contention

The AO-16 command team recommends that users of the AO-16 PBBS system use only channel D (145.960 Mhz) for downloads and directory requests leaving channels A, B, and C (145.900, 145.920, and 145.940 Mhz for file uploads, digi users, and bulletins requested through PB. Even if all four users who are logged on at a given time are doing downloads or directories, contention on uplink channel D should be minimal. This is because the single downlink channel from the satellite sends packets to each of the stations sequentially. When one station receives its packet, it will acknowledge on the uplink while a downlink packet is sent to the next station. Since no two stations will be receiving packets on the downlink at once, no two stations should key up to acknowledge at once if their TNC parameters are set correctly. The current version of the file server only allows four connected activities at a time. Use of one of the new PG.EXE versions, (release date either February 6 or February 7, 1991) will help too. These versions of the upload-download- directory software monitor the downlink for open BBS slots and attempt to initiate connects to the satellite only when first commanded by the user and thereafter only when BBSTAT indicates an opening. For uploads, please tune to a channel that is indicated to be open in the BBSTAT message, for downloads, please tune to channel D (145.960). Stations uploading files should stay off of the download/directory channel D as their longer uplink packets will collide with acks uplinked from downloading stations. Stations doing downloads should stay off of

```
File #     ¦Holes¦File size ¦Pkt Offset ¦                                  Files Heard
0x00000e76    5  Unknown     0x00001300                                   ¦ 0x00000e76
0x00000e02    4  Unknown     0x00001b00                                   ¦ 0x00000e02
0x00000e92    1  Unknown                                                  ¦ 0x00000e9e
Inactive.                                                                 ¦
Inactive.                                                                 ¦
Inactive.                                                                 ¦
Inactive.                                                                 ¦
Inactive.                                                                 ¦
Inactive.                                                                 ¦
Inactive.                                                                 ¦
Total bytes in: 0x00001598 ¦ CRC errors:0002   ¦
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>N4IFD :  : UI]
OK
[PACSAT-11>QST-1 :  : UI]
[PACSAT-11>QST-1 :  : UI]

Requesting file 0xe92 with 244 bytes per frame.
Begin. Cap. Grab. Hex. Data. Heads. Txd. Info. Shh. Kiss log. Quit. ? help.
```

channels A, B, and C since their frequent but short ack packets will collide with longer uplink attempts seriously degrading uplink performance. As AO-16 and the other new pacsats become more popular, various experimental techniques like this will be recommended in order that the new satellites will be able to accommodate as many users as possible as expeditiously as possible.

Recommended AO-16 operating practice in summary:

Downlink: 437.025 Mhz (437.050 and 2400.143 on experimenter's day.)

Uplinks:
145.900 A uploads
145.920 B uploads
145.940 C uploads
145.960 D downloads and directories
Either A, B, or C may be used in PB for the "B" command.

Note: the above operating suggestion was in a file to "ALL" that I downloaded off of AO-16. This is current practice of PACSAT; please use it until something different is published-watch the satellite!

NOW COMES THE UPLINK!

Now comes the real challenge using PG to select files from the directory aboard the pacsat; asking for downloads of those files; and then the real purpose of reading all this stuff-uploading your first file to the Pacsat File Server.

After you are comfortable with the PB program and have your transmitter's deviation adjusted you are ready to try the PG program. This comes up with a screen somewhat like PB but allows you to upload files to the satellite as well as request directories from the satellite and then based on that directory ask for downloads of specific files.

When the bird comes up tune it in with PB as before and the moment you are sure that lock is achieved depress the "Q" to exit PB. Immediately key in PG and hit return. The PC will start to load the ground station software into your PC. When that screen comes up depress the "B" key that will give you a listing of all the "Bulletins" on the pacsat. Bulletins in this context are those files uploaded by various amateurs that are addressed to ALL-things of general interest. If everything in your station is correct the pacsat will come back with a screen like the one on page 30, or you will get the message:

PACSAT BUSY:

Either way you have done it; you have linked to the satellite. If nothing happens after a few tries; go over everything again and

```
cmd:PACSAT-12>BBSTAT:FULL A   : KG4TM  KB9CML VE1HD  WB9ANQ
PACSAT-12>BBSTAT:FULL A   : KG4TM  KB9CML VE1HD  WB9ANQ
PACSAT-12>BBSTAT:Open
 A   : KB9CML VE1HD  WB9ANQ
cmd:
connect pacsat-12

Logged in at Mon Apr 08 02:45:37 1991
PACSAT protocol server version 00.
Selecting ALL FILES newer than Sun Apr 07 00:00:18 1991
Selected : 28 files.
Requesting directory.
Bytes received: 1891
Directory successful.
Requesting directory.
Bytes received: 1625
Directory successful.
Requesting directory.
Bytes received: 1337
Directory successful.

cmd:d
cmd:
LINKED            To abort, hit the ESCAPE key.
Quit. Upload. Download. List Mine/Bulls/All/One. View dir. Terminal. Utility.
```

check each part of your uplink carefully. Another way to check what is going on is to hook up a tape recorded and record the audio during the pass. When the pass is over play it back feeding the audio out of the recorder into the spot where you have injected the audio from the receiver into the PSK/TNC. Meanwhile run the PB program on your PC and have an INSTANT REPLAY of the pass. By using PB to monitor this taped pass you will be able to see all the messages that are being downlinked by the pacsat and you may see your call among them. This is an excellent way to troubleshoot any transmitter problem as well as be able to also have the benefits of capturing all the broadcasted files in PB as the tape plays. As you have by now noticed PG doesn't show you anything on the screen except who else is linked to the pacsat along with whatever your station is doing. Watching the pass in PB is far more interesting.

The fact that headers and data don't routinely scroll across the screen is why I suggest you first tune the downlink using PB and then switch to PG. When your "ear" for PSK gets better you can bypass this step.

In the subdirectory called "\PACDOC" on the diskette is the documentation associated with the PB/PG suite of programs. Now is the time to read it. It is extensive and extremely informative. It will give you the specifics of just how to prepare a file for upload. It worked for me the first time! I also had spent a lot of time with a helpful ham in the area getting my deviation spot on.

This is where you quit being a beginner and become a user of these marvelous birds. This Guide has concentrated on using PB and hearing the satellites. With just a little more effort on your part in thoroughly reading the \PACDOC files you will know all I know about the pacsats.

By the way, I am very interested in what you thought of this Guide, did it help? where could it be improved? etc. It can only be made better for the next amateur that buys it if you take a few minutes to comment on it. It would please me greatly to have your comments on this Guide be your first .UP file. Just sent it to me N4IFD care of one of the pacsats!

For AMSAT and all who helped make the pacsat dream a reality
Thanks and 73's

Mike Crisler, N4IFD
17514 SW 83rd Court
Miami, FL. 33157
305-378-9971
Before 9:00 PM EST/EDT

ADDENDUM TO
PACSAT BEGINNERS GUIDE
REVISION 4/1/92

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An update of the original PB document showing
how to use the revised program.

UO-22 USERS LIST .... Page 11
A list of UO-22 users showing their equipment and computers.
Excellent for ideas on what to use yourself.

ADDENDUM NOTES

This Addendum is the work of:

Dave Medley, KI6QE
Roy Welch, W0SL
Dick Schiller, K4BQH
Don Adams, WD4NAE
Bob Myers, W1XT
Jeff Ward, G0/K8KA

Additions, corrections and comments may be sent to Dick Schiller, K4BQH, 5809 Summit View Lane, Crestwood, KY 40014. (502) 222-0586. Compuserve 73617,501.

DSP BOXES

The letters DSP stand for "Digital Signal Processing". This is not as imposing as it first sounds. We are all familiar with "Analog Signal Processing" (ASP). In ASP we use resistors, capacitors, transformers, diodes and other discrete components to change the value of a voltage. The "Signal" part merely means the voltage that represents the "information" in the circuit. The "Processing" part merely means "changing". Therefore ASP is the old fashioned changing of a voltage by means of discrete electronic components.

In ASP we can change a voltage by using a transformer or a dropping resistor. We can change an A.C. voltage to D.C. by using a diode and then smoothing the lumpy wave form with a capacitor circuit. We can change a low voltage to a higher voltage with a transistor circuit (amplification).

With DSP we also change the value of a voltage, but we do not use discrete components. Instead we use digital techniques with a device much like a computer.

First, we change the voltage to numbers that a computer can read. We do this with an "Analog to Digital Converter" (ADC). These numbers are then manipulated in a manner which produces the desired output numbers. For example: If we wished to double a voltage, we would convert the analog voltage to a digital form in our ADC. We would then digitally multiply by two, giving us the digital form of twice the voltage. If we desired an analog voltage as the output of our DSP, we would then reconvert the digital output of the multiplication to an analog signal by using a "Digital to Analog Converter" (DAC).

In a DSP box which is emulating a TNC, the receiver audio is routed to the DSP box which then:

1. Converts the audio to a digital signal (ADC).

2. Acts on the digits to perform the function mathematically, as a modem might do with analog components.

3. Sends a digital signal to our computer to be acted upon by the computer program. (Notice that it does not, in this case, reconvert the signal back to an analog signal since our computer can act on digital signals directly.)

The advantage of the DSP configuration is that the manipulation of the digital signal inside the box is all done with software, (or firmware in the form of an EPROM). This means that a DSP box can be programmed to duplicate the functions of any of the modems that we now use. It can demodulate RTTY, AMTOR, PSK, AFSK, 400 BAUD TELEMETRY, FSK (UO-22), WEFAX, or any other modulation system that one would choose to program into the box. Once you acquire the initial DSP box, you change modems simply by changing the program running inside the box!

You can see that all you need is a single box to decode the information from all of the satellites presently flying. In addition you get terrestrial packet capability. When future satellites come along (Ex: Phase 3D or a future RUDAK) you will not have to buy a new "box".

The disadvantage is that this versatility is not inexpensive. If you have no modems at all, and want to get into the game, a DSP is a solid choice as it is more cost effective than buying all of the modems and TNCs needed to get into all of the birds and terrestrial packet. If you already have some equipment (modems, TNCs) you will have to calculate the difference in cost to see which route is less expensive.

Many hams are using the DSP-12, from the L.L.Grace Company, on the PACSATS and it is proving itself to be worthy on all the birds, especially UO-22. AEA also has the DSP-2232 unit on the market. The hookup to most receiver/transmitter combinations is very simple. The software is still in development stage and each version or upgrade offers improvements of one kind or another. This upgrading is likely to continue well into 1992.

Digital signal processing is sure to become more prevalent in ham radio. It is already used on several transceivers and audio filters. Perhaps it is time to read the *ARRL Handbook* and other sources to become familiar with the general techniques. While the mathematics is difficult the average ham can master the general principles of DSP.

Some books and articles on DSP are listed below:

1. *Digital Signal Processing Experiments* - Alan Kamas and Edward Lee, Prentice Hall, 1989 (Disk provided with book).

2. *PC-DSP* - Oktay Alkin, Prentice Hall, 1990 (Disk provided with book).

3. *Introduction to Digital Signal Processing* - Proakis and Manolakis, McMillan Publishing Co., 1988. (This is a college text and could be tough going unless you are handy in math).

4. *An Introduction to the Analysis and Processing of Signals* - Paul Lynn, Howard Sams and Co., Inc., 1983.

5. *ARRL Handbook* - American Radio Relay League, 1990.

6. *Communications Quarterly* - This quarterly ham magazine has included DSP articles in almost all of its issues. This publication started late in 1990 and five issues have been published to date.

UO-14

Due to the very heavy load being placed on UO-14 and the fact that this satellite was being shared with amateurs by a non-amateur organization, the decision was made to remove this satellite from amateur operation for the time being, and move all amateur operations to UO-22. The load was so heavy on UO-14 that users had begun to find that when they attempted to upload messages, they would be rejected because of a lack of file space in the satellite. From the amateur standpoint, the switch to UO- 22 has two important advantages:

More directory entries — 800 to be exact. This means that messages will have longer lifetimes. The default lifetime can be increased for bulletins while shorter lifetimes can be recommended for other mail.

More uplink channels — Because UO-22 is not supporting non-amateur activities, both receivers can be switched to AMSAT uplink channels. On UO-14 the downlink would often be switched to the non-amateur frequency, interrupting the amateur activities.

UO-22

This satellite has a downlink on 435.120 MHz. There are two uplink frequencies, 145.900 and 145.975 MHz. The 145.975 frequency is used to upload messages using PG while 145.900 is used to request broadcasts of files with PB. Both the uplink and downlink are FM modulated with a data rate of 9600 bits per second (bps). In addition to the regular BBS functions on this satellite UO-22 transmits telemetry and experimental data. It also sends photographs taken by an on-board camera. The photos are copied on 435.120 MHz using exactly the same procedures used for capturing regular BBS traffic. The photos are rather large, taking about 352 kilobytes for each one. The satellite periodically broadcasts a directory of all available files on the satellite by file name. The picture files are identified by the subject name "IMAGE". Using your PB program, you can request a broadcast of any of these files. If you request an image file, you will be put in queue and the image file will be broadcast when your turn in the queue comes. Once the photo has been received (it will usually take more than one pass to receive the complete photo because of the number of people asking for broadcasts) the file must be decoded. A special program by VK5AHI called "DISPLAY", is used to decode the photo. From time to time the more exceptional photos may be taken from CompuServe or other bulletin boards. "DISPLAY" does not put the photo in the .GIF format. However, there are several programs available that can be used to arrive at the .GIF format. Downloading and editing photos is a branch of amateur radio that has a growing group of devotees. See the list at the end for people who can help in this phase.

UO-22 is quite different from the other satellites mentioned. To achieve satisfactory communications with this satellite it is necessary to modify some transmitters and receivers. Others do not require modification, but do require audio connections at particular points in the receiver and transmitter. Because the passband is wider than many receivers can accommodate, especially as Doppler shift moves the center frequency while copying, it may be necessary to change the receiver IF filter. Using the Yaesu 736 as an example, the earlier models used a 12 kHz IF filter. The later models used a 15 kHz filter. Some people have been able to use the 15 kHz filter, but most have changed their filter to a 20 kHz filter. Some have even gone to a 30 kHz filter, where they find that the signals stay in the passband even with high Doppler shift. Changing filters in the Yaesu 736 is not expensive and not difficult.

Because each rig has its own peculiarities it is not possible to list all of the modifications in this short article. Instead we have accumulated the names, addresses and telephone numbers of those people who are willing and able to help with modifications for the more common rigs. This list of technical help appears later in this article. These people have successfully operated on UO-22 with their modifications. Feel free to call them for help.

Although it is possible to manually tune your receiver to take care of the Doppler shift that will be experienced on UO-22 (up to 20 kHz at times) many users find it more convenient to use some kind of automatic Doppler correction. Up until this time, the only commercially available unit for automatically controlling your receiver was the Kansas City Tuner. (The same company which produces the Kansas City Tracker and the DSP-12). A new unit in kit form has just been made available by TAPR/JAMSAT and is called "TrakBox". It will also control an antenna and do some other things. It is a self contained stand-alone unit. Further information on its capabilities is available from TAPR in the USA.

The KCT (Kansas City Tuner) can be used with most receivers which have an RS-232 serial port capability built into the unit, or which offer frequency control via the "mike click" method. If your microphone has the up/down buttons, you are probably capable of controlling your rig frequency in this manner with the KCT.

The frequency of the transmitter can be left in one spot although many people also control the uplink frequency with the KCT via the serial port method.

SOFTWARE

The software on the satellites is continually undergoing changes. At this writing, AO-16, LO-19, and FO-20 are as described in the Guide. However, the spacecraft and ground station software for UO-22 has undergone a much needed change that makes operation of this satellite a pure delight.

Due to the popularity of the 9600bps data rate on this satellite there is a growing number of stations accessing UO-22 daily. This has brought about problems caused by heavy use in the U.S., Europe and Japan. Before this latest software change, at peak times of use it was sometimes not possible to access the PG mode in order to obtain a directory. This meant that you might miss a newly uploaded message for 12 to 24 hours. (Not the end of the world, but not much fun either!)

The answer lay in sending the directory in the "Broadcast" mode, rather than a "Connected" mode. This capability has been written into the PB program and spacecraft software by Jeff Ward late in 1991, and has since been loaded into UO-22. As of this writing this capability has not yet been made available on AO-16 or LO-19, however it soon will be. The changes to the program are explained under a later section in this Addendum.

Since the programs will certainly undergo further changes periodically, use the name at the end of this Addendum to find out the latest changes and protocol for using the satellite. Eventually the same programs will be used with AO-16 and perhaps LO-19.

PACSAT GATEWAY OPERATIONS

When Packet Radio first started operation, it was essentially on the VHF bands and thus, restricted to line of sight operation. This range was extended by the installation of mountain-top digipeaters, and before long, many states had good coverage through networks of digipeaters.

However, any long range relaying of traffic, particularly Bulletin Board Traffic, took a long time and many places were not reachable at all. For example, it was not possible to send a packet message from East to West or even from California to Texas.

So hams began experimenting with packet on the HF bands, and although limited by regulation to 300 baud, worldwide coverage was soon obtained and packet messages began to be transmitted over long haul distances. The HF stations providing this service became known as "Gateways" because they provided a gate through which traffic could pass to locations unattainable by the VHF system.

Other Hams began experimenting with other modes, such as AMTOR, to provide gateways to far distant locations. This system works well and provides a good service worldwide, but suffers from all the vagaries of HF transmission. In periods of poor propagation, traffic delays of weeks and even months have been experienced in various parts of the world.

The advent of the Microsats in 1989 and the subsequent development of their capabilities presented a possible solution to the HF delay problem. This was first recognized by an Amateur BBS SYSOP in Anchorage, Alaska. He had been through the earthquake in Anchorage and experienced the frustration of being unable to pass his Emergency (ARES/RACES) traffic via HF to destinations in the USA. In conversations with an AMSAT VP in early 1990, they developed the concept of using PACSAT as a store and forward message system between Alaska and California. This would be particularly valuable in an emergency situation, such as an earthquake or other natural disaster.

So the services of another Ham in California were obtained and satellite gateways were opened in Anchorage and Los Osos, CA, using PACSAT. BBS personal message traffic began passing over this route regularly in late February 1990. The efficiency of this system was soon demonstrated and both gateways developed systems to interface PACSAT with the terrestrial packet network.

Other Ham operators noted this experiment, and soon requests were coming in from them wanting to join in and pass traffic to many distant locations. By the end of 1991, there were 30 satellite gateways world wide, some of them automated, and all interfacing with local networks. Traffic volumes of up to 100 messages per day pass through some of these gateways.

Soon it became apparent that it was unwise to depend on one satellite for this service and LUSAT started being used with the active support of AMSAT Argentina. Later, others began experimenting with the 9600 baud satellite UOSAT3

PACKET SATELLITE GATEWAY STATIONS

CALL	@BBS	LOCATION	HIER ADDR.	SERVICE AREA
NORTH AMERICA				
KI6QE	AA6QD	Los Osos CA	#CENCA.CA.USA.NA	CA,OR,WA,UT,ID,NV,AZ,VE6,7,8#
NL7NC	KL7AA	Anchorage AK	#NAK.AK.USA.NA	AK
VE8DX	VE8DX	Baffin Is	#BAF.CAN.NA	Baffin Island only*
WA0PTV	WA0PTV	Fredonia NY	#WNY.NY.USA.NA	NY,NH,RI,VT,MA,ME,VE1,2,3
KF4WQ	KF4WQ	Selinsgrove	#NCLBT.NC.USA.NA	NC,SC
W0SL	K0PFX	Manchester	.MO.USA.NA	KS,MO,IL,IA,KY,TN
NU9H	WV9O	La Porte IN	#NWIN.IN.USA.NA	IN,IL,MI,KY,WI,VE4,5#
NR3U	NR3U	Selinsgrove	#NCPA.PA.USA.NA	PA,NJ,OH,MD,VA,GA*
N0GIB	N0GIB	Sioux Falls	SD.USA.NA	SD,ND,WY,IA,NE,MN
W5ERO	W5ERO	Lubbock	#WTX.TX.USA.NA	TX,NM,OK,AR#
KG4TM	KG4TM	Guantanamo	.CUB.CAR.NA	Guantanamo, Caribbean area#
WH6AQ	WH6AQ	Honolulu	.HI.USA.OC	US Possessions. Pac Area.*
W7LUS	W7LUS	Ft Lauderdale	.FL.USA.NA	FL, GA, KY, AL
EUROPE				
ON4KVI	ON4KVI	Vielsalm	.BEL.EU	Western Europe
EI6EH	EI6EH	Kells	.IRE.EU	Ireland, Denmark*
OH6KG	OH6KG	Karleby	.FIN.EU	Finland Sweden Norway*
GB7LAN	GB7LAN	Lancaster	#16.GBR.EU	UK #
SV8RV	SV8RV	Zakynthos	.GRC.EU	Eastern Europe, USSR
OCEANIA				
ZL2AMD	ZL2AMD	Napier	.#40.NZL.OC	New Zealand, South Pacific*
VK4BBS	VK4BBS	Brisbane	#SA.AUS.OC	NSW,QLD,TAS,NT,ACT#
VK5ZK	VK5ZK	Adelaide	#SA.AUS.OC	SA,WA,NT,QLD#
VK8SO	VK8SO	Alice Springs	Alice Springs	
FO5LQ	FO5LQ	Tahiti	.TAH.OC	French Polynesia#
YB0QC	YB0QC	Jakarta	.IDN.OC	Indonesia, SE Asia
MIDDLE EAST				
4X1AS	4X1RU	Tel Aviv	.ISR.MDLE	Israel
FAR EAST				
JA6FTL	JA6FTL	Kagoshima	.JNET6.JPN.AS	JA,DU,VS6,BV,YB AFRICA*
ZS1ABM	ZS1ABM		.ZAF.AF	South Africa
SOUTH AMERICA				
LU8DYF	LU8DYF	Olivos	.OLIVOS.BA.ARG.SA	CX,CP,OA,CE,PY,YV,LU/LW
LU1ESY	LU1ESY		.ARG.SA	CX,CP,OA,CE,PY,YV,LU/LW
LU7ABF	LU7ABF		.ARG.SA	CX,CP,OA,CE,PY,YV,LU/LW

* 9600bps only # 1200bps only

TABLE 1 **Information current as of 04/01/1992**

(UO14) until amateur operations were moved from that satellite to UOSAT5 (UO22). Now most gateways use this mode with LUSAT/PACSAT as a backup.

Table 1 above sets out the gateways which are available as of this writing. This list grows all the time and you should watch for bulletins which provide updated lists from time to time.

GATEWAY MESSAGES

Messages may be uploaded to any of these gateway stations using normal satellite packet addressing procedures. Obviously this type of gateway traffic is intended for long haul traffic, not for traffic going across the state where terrestrial networks will do the job better. Just be sure you have the correct hierarchical address. When preparing the message for upload (PFHADD), select the gateway nearest the final addressee as the destination. Some gateways are using automated procedures and for these to work, the original message text file must have an extension of "IN" such as *.IN. It then must be compressed using the PKZIP program. Following this the "zipped" file must be processed using the PFHADD program to add the proper satellite header converting the file to an *.OUT filename. The following procedures are currently being used by the satellite gateway stations:

UPLINK FILE NAME FORMAT

MOddnnts.IN (for the original file)
MOddnnts.ZIP (for the PKZIPed file)
MOddnnts.OUT (for the uplink file using PFHADD)

Where dd = Day of month
nn = Message serial number. Restart at one (1) each day.
t = Message type
- T = Regular traffic
- A = Service messages
- N = NTS traffic
- B = Bulletins

s = Satellite used
- 1 = UO14
- 2 = LO19
- 3 = AO16
- 4 = FO20

Example: N5NGJ wishes to send a message to his friend G3EMU at the GB7ZAA BBS in section #34 in Great Britian via UO22. It is March 14, 1992 and this is the first gateway message of the day for N5NGJ.

N5NGJ prepares a file AR1401T1.IN in the following format:

```
SP G3EMU @ GB7ZAA.#34.GBR.EU < N5NGJ.AR.USA.NA
(Title)
(Text)
/EX
```

After the file AR1401T1.IN has been "zipped" it is prepared for uploading using PFHADD. When prompted for the destination station, GB7LAN is entered as the destination gateway station and the message is sent on it's way on the next orbit pass.

If you do not have satellite capability, you can still use the gateway system. If you live within range of one of the listed gateways, or can reach it via digipeaters, then just use normal packet addressing procedures. Be sure you get the hierarchical address correct.

It is most desirable to use direct addressing if at all possible, so you should encourage your SYSOP to include this facility in his BBS. If you cannot reach a gateway directly, then check with your local SYSOP. In some areas, such as California, Missouri, New Mexico, Arizona and Texas, you can still use normal procedures even if you are not within range of a gateway.

If your SYSOP advises you that he has not implemented satellite forwarding, then you can use what is called an INSIDE ADDRESS. In this procedure, you address the message to the nearest gateway and include the entire message, including the full hierarchical address in the text. Use the following address format:

Example of a message to DU1ABC sent to the W0SL gateway for uplinking to the satellite:

```
SP W0SL @ K0PFX < (originating station) @ (originating BBS)
VIA SATELLITE
TO:DU1ABC @ DU1EAG.MNL.PHL.OC
(subject)
(text of message)
/EX
```

Example of a message carrying NTS Traffic sent to the W0SL gateway for uplinking to the satellite:

```
SP W0SL @ K0PFX < (originating station) @ (originating BBS)
VIA SATELLITE
TO: (zipcode) @ NTSXX < (originating station @ orig. BBS)
NTS Traffic to (zipcode) or (phone)
(full name and address of destination)
(text of message)
/EX
```

Note: The XX in NTSXX is the two letter destination state abbreviation. Foreign NTS traffic will not be accepted at the present time.

If you have any questions address them to your nearest gateway or to Dave KI6QE @ UO22, AO16 or LO19.

LISTING OF TECHNICAL HELP

YAESU 726

WJ9F
RUSSELL PLATT JR.
4226 PEPPERTREE AVE
CONCORD, NC 28025
(704)789-4949

WA4SXM
G. GOULD SMITH
8008 CHESTERFIELD DR
KNOXVILLE, TN 37909

YAESU 736

N4OUL
GLENN MOODY
2708 S. 3RD ST
LOUISVILLE, KY 40208
(502)634-4081

WB9ANQ
BRUCE RAHN
410 CORONADO TRAIL
ENON, OH 45323
(513)864-5803

ICOM 970

NM0H
DALE HAGERT
3881 SERPENTINE CIRCLE
EAGAN, MN 55122
(612)452-1030

ICOM 475/275

W9FMW
JACK MATHIAS
721 MEADOW ROAD
EVANSVILLE, IN 47715
(812)477-4799

W0SL
ROY WELCH
908 DUTCH MILL DR.
MANCHESTER, MO 63011
(314)391-1127

GENERAL SATELLITE INFORMATION CLEARING-HOUSE

N4PLY
JOHN KUKLINSKI
Phone: (305)254-0016
4pm - 11pm Weekdays,
9am - 11pm Sat./Sun.
Compuserve #70410,3301

PB

The PACSAT Broadcast Groundstation Program

User's Documentation Rev. 0.02
Written by Jeff Ward, G0/K8KA
Minor changes by Roy Welch, W0SL to agree with the change from UO-14 to UO-22.

Rev 0.02 (as of version PB 920224m):

Added "automode" switch to turn off all automatic transmissions (2.3.8). Added "maxpfhdirsize" and "minpfhdirsize" (2.3.9) which control the archiving of pfhdir.pfh (the main directory file). Added "makebat", "bats1" and "bats2" which control the automatic construction of a post-pass file-processing batch file.

Rev 0.01 (as of version PB 911221r):

Added "exitafter" in section 2.3.6 Removed warning r.e. "actdays". 2.3.5 Bug in slist.dat fixed. Those who ever used version 911220s read file "slistfix" and carry out fix procedure.

The PACSAT Broadcast Groundstation Program

This documentation relates to versions of PB with version dates 911220 or newer. Users of older PB versions are strongly encouraged to update!

PB is an groundstation program for receiving messages and message directories from satellites running the PACSAT Protocol Suite. AO-16, LO-19 and UO-22 are all compatible with this software.

[As of the current time, only UO-22 supports the broadcast directory system used by PB. The other satellites should follow in the near future.]

PB will run on any IBM compatible Personal Computer running MS-DOS. [Version 5.0 and 3.x have been extensively tested.] Although PB will run on a PC or XT machine, serious users of UO-22 (9600bps) will desire at least a 12 MHz AT. A hard disk or ramdisk is also necessary.

PB requires a terminal node controller (TNC) which supports the KISS interface mode. TNCs with KISS EPROMs are supported, as are TNCs which recognise the TAPR-style commands for entering KISS mode.

1. PRINCIPALS OF OPERATION

Two aspects of PB and PACSAT operation are unfamiliar to users of terrestrial packet radio: the client/server relationship and the use of "broadcast mode". Both of these concepts are essential to an in-depth understanding of PB.

1.1

1.2 Message Status

When you are in the Directory View window, you can see a message's status in the column headed

"S". [Although I am looking at more colorful and cryptic markers] the status markers are interpreted as follows:

n - Never

This message will not be automatically downloaded and filled, nor will it be saved if it is overheard when another station is downloading it.

g - Grab

This is the next step up from "Never". It means that the message will be saved if it is overheard when another station is downloading it, but it will not be automatically filled.

A - Automatic

This is the standard automatic status. It means that the message will be completely downloaded and filled automatically, without your intervention by the PB program. When the message is completely filled, it will go to the SQUARE BLOCK. [which is a pain in the ... when writing ASCII documentation].

P - Priority automatic

This allows you to place some messages "before" others in the automatic downloading system. All messages with Priority will be downloaded and filled before any messages with merely Automatic status. This is useful if you want a short message which is "behind" a longer message that you have marked Automatic.

SQUARE BLOCK - Downloaded

The message has been completely downloaded. When this first happens, the message will be in the PB working directory, with the name xxxx.DL, where xxxx is replaced by the message number.

E - Error (permanent)

The server has indicated that this message cannot be downloaded. Either it is not there or you are not allowed access to it. This status is permanent, until you change it manually.

e - Error (temporary)

The server has indicated that the message cannot presently be downloaded, but might become downloadable later. This status is cleared when you exit PB and the previous (A/P) status is restored.

N.B. - If you changed the status of a Downloaded message to A/P/g, you will receive another copy of that message.

2. PB.CFG CONFIGURATION OPTIONS

When it is run, PB reads a configuration file. The default file name is PB.CFG, and it must be in the current DOS directory. Alternatively, you can specify the complete DOS path to and name of the configuration file. (If you specify the path/filename, you will probably also need a "pbpath" entry in the config file to make sure that PB actually looks for and stores all of its files where you really want them. See below.) The configuration file must be a pure ASCII file like AUTOEXEC.BAT or CONFIG.SYS. It must not be edited with a normal word processor which may insert control characters.

A sample configuration file comes with the PB program release. Some entries you must edit. Others you might need to. Others you can if you want to. Others you are discouraged from editing.

2.1 MUST EDIT:

2.1.1 mycall <call>[-<ssid>]

Your station callsign. <call> is 6 or fewer ascii characters. <ssid> is an optional number from 1 to 15. Please do not use an <ssid> unless you have a very good reason.

2.2 MAY EDIT:

2.2.1 alias <string>

Other names you might be called. This is used during automatic message scanning. For example, people sometimes mess up my callsign when sending me messages, so I also have

```
alias K8KA
```

in my file. That way if they send messages to "gok8ka" or "g/k8ka" PB will still find them and download them for me.

2.2.2 bdcstcall <call>[-<ssid>]

This identifies the satellite you want to communicate with. The distribution file is for UOSAT3-11, so when you make a configuration file for another satellite, you'll need to change this. Some other satellite calls are:

pacsat-11
lusat-11
uosat5-11

2.2.3 port 1|2

Default COM1

Sets the communications port. Only COM1 and COM2 are supported. This is the port your TNC should be connected to. If you normally use a TSR serial communications driver (COMBIOS, MBBIOS, etc) remove it before running PB.

2.2.4 speed <baud rate>

Default 19200

This is the speed that you have your TNC asynchronous port set to. This is not directly related to the downlink or uplink speed of the satellite, although it is recommended that you run your asynchronous port faster than your satellite port. For UO-22 this means running the asynchronous port at 19200 baud.

2.2.5 pbpath <dos path>

Default is the current logged directory

PB will look for and create certain data and message files during its operation. If you don't have a "pbpath" entry in your configuration file, PB will use the currently logged DOS directory. If you want to make sure you know where PB is putting its files, put a "pbpath" entry in the configuration file. For example

pbpath c:\pacsats\uosat3

would tell PB to find/put all data and message files in the directory "\pacsats\uosat3" on drive C.

2.2.6 txd <tx keyup delay msec>

Default 150 msec

This is the number of msec between the keying of your transmitter and the transmission of data.

2.2.7 restart_delay <delay after restart cmd>

Default 60 (in 1/18 second increments, e.g. 3.333 seconds)

This delay tells PB how long your TNC takes to get into KISS mode. Most TNCs flash their lights 3 times while entering KISS mode, and PB must not try to communicate with the TNC during this time.

2.2.8 aea_delay <delay before restart cmd>

Default 1 (as above, e.g. 0.055 seconds)

This delay is necessary on some "smart" TNCs. If your TNC won't go into KISS mode, then try bumping this up a lot to cure it.

2.2.9 break_delay <delay after break>

Default 9 (as above, e.g. 0.5 seconds)

This delay allows the TNC to get its cmd: processor sorted out before we try to send commands to the TNC.

2.2.10 silent 0|1

Default 0

Set silent to 1 if you don't want any warning bells.

2.2.11 kisstnc 0|1

Default 0

If you have KISS EPROMs in your TNC, or otherwise put your TNC into KISS mode before running PB, set this to 1.

2.2.12 paclen <bytes>

Default 244

When your station requests something from the satellite, it asks the satellite to transmit packets of this length. If you have not set up your downlink receiver for peak performance, you may wish to reduce this length. In general, you should not change this.

This has no effect on uplink packet size.

2.2.13 trace 0|1

Default 0

Little general importance. Trace is used to monitor connected mode activity on the downlink.

2.2.14 tncid <id>

Default 0

Little general importance. Allows you to set a multidrop KISS address.

2.2.15 ndupesearch <depth>

Default 100

Very little general importance. When a new directory entry is received from the satellite, it may be for an updated version of a spacecraft log file. PB will scan the newest <depth> entries in your directory to find out if this is true.

2.2.16 maxpfhsize <bytes>

Default 500

Very little general importance. The PFH is the header or envelope which encloses messages on the PACSAT server. This PFH is also the "directory entry" which PB stores for the directory view mode. PFHs can be any length. If people start using really big ones, you might have to increase this number. A message will show up in the message window if this is ever the case.

2.2.17 logbbframes 0|1

Default 0

Little general interest. If 1, put all broadcast protocol data frames in the KISS log.

This and the next two entries (logdbframes, logothers) control what KISS frames get stored in the KISS log files. KISS log files are "raw output" from your KISS TNC. They are stored in files called yymmddhh.KSS, where yymmddhh is replaced by the current time. These files are useful for debugging or for keeping statistics.

2.2.18 logdbframes 0|1

Default 0

Little general interest. If 1, put all directory broadcast protocol frames in the KISS log.

2.2.19 logothers 0|1

Default 0

Some general use. If 1, put all frames which are not broadcast directory or data frames into a KISS log file. This might be used to capture telemetry frames for later processing.

2.3 CONTROL OF AUTOMATIC OPERATION AND FILE MAINTAINANCE

2.3.1 dirupdatemins <minutes>

Default 15

Tells how many minutes after bringing the directory up-to-date, the directory should be updated again. This is set to some time greater than the average pass, and allows PB to be left running overnight. The directory will then be updated every pass, even though you haven't quit and re-run PB.

2.3.2 autoselect 0|1

Default 1

If this is 1, PB will automatically check every new received directory entry to see if the message has your call or alias in the DESTINATION: field. If so, the message will be marked for Automatic downloading and hole filling.

2.3.3 blockftype <decimal file type>

Default none.

You can have up to 10 "blockftype" entries in your configuration file. Each one specifies a certain type of file that you don't want to receive (unless you specifically, manually mark it A, G or P).

(If autoselect and blockftype disagree about a file, autoselect wins.)

2.3.4 graball 0|1

Default 1

Because of the way broadcast mode works, you may hear part of a message being transmitted to someone else before you have received the directory entry (PFH) for that message. If you have graball on, these bits of messages will be captured and saved unless they are blocked by a "blockftype" entry.

N.B. I WOULD GREATLY APPRECIATE IT IF EVERYONE LEFT THIS FLAG AT 1. THIS WILL ALLOW THE GREATEST RE-USE OF PACKETS ON THE DOWNLINK AND WILL MAKE THE SATELLITE MORE USEFUL FOR EVERYONE. IF YOU ARE WORRIED ABOUT THE PROLIFERATION OF .ACT AND .HOL FILES, SEE 2.3.5 IMMEDIATELY BELOW AND MAKE GOOD USE OF "BLOCKFTYPE".

2.3.5 actdays <days>

Default 3

Tells PB how long to keep grabbed message fragments. If you set this to 0, all partially-received messages will be deleted immediately when you exit PB. This is better than turning "graball 0".

2.3.6 showgrabs 0|1

Default 0

If 1, then every time a broadcast message packet is heard, a cryptic explanation of why it is/isn't being grabbed will be printed in the Message Window.

2.3.7 exitafter <minutes>

Default 0

If this is not 0, PB will exit if it hasn't heard a packet for the given number of minutes.

2.3.8 automode <0|1>

Default 1

If this is set to 0, no automatic transmissions will take place.

2.3.9 maxpfhdirsize <bytes>

Default 100 kbytes

When pfhdir.pfh reaches this size, it is automatically renamed as "archDDMM.PFH" where DDMM are replaced with a date stamp. A new pfhdir.pfh file is created, containing some of the more recent entries from the old file.

2.3.10 minpfhdirsize <bytes>

Default 25 kbytes

Sets the size of the new pfhdir.pfh created during archiving (2.3.7). The default setting saves 25 kbytes of newer entries.

2.3.11 Batch File Creation

To assist in the post processing of newly-received files, PB will create a batch file containing the file number for every newly-received file. This batch file can be run after the pass. The batch file is called postpass.bat. Using the default settings, it will have 0 or more lines like call dofile 45ab where "45ab" in the example is replaced by the file number of a downloaded file.

If you want to customize the entries in postpass.bat, you can set two strings: one (bats1) which comes before the file number and one (bats2) which comes after the file number. For example, if pb.cfg contained the lines bats1 'this is the file number' bats2 'just downloaded.' then each line in postpass.bat would look like this is the file number 45ab just downloaded.

The default is for PB not to create postpass.bat. If you want to turn this feature on, put the line makebat 1 into pb.cfg.

3.0 CONTROL KEYS

Control keys are now used to toggle ON/OFF certain aspects of PB operation.

ctrl-a Toggle automatic operations on/off.

ctrl-z Zoom/Unzoom the Downlink Window.

ctrl-d Toggle the display of data bytes in the Downlink Window.

ctrl-t Toggle trace mode in the Downlink Window.

ctrl-h Toggle the display of AX.25 headers in the Downlink Window.

ctrl-x Toggle the hexadecimal display of data in the Downlink Window.

ctrl-k Toggle the status of the "logothers" flag. See 2.2.19.

ctrl-g Toggle the status of the "graball" flag. See 2.3.4. DON'T DO IT.

4.0 MENU SELECTIONS

There are two menus. One is the "Main Menu" and the other is the "Directory View Menu". You will generally want to interact with PB through the Directory View Menu. Each menu has a (H)elp option which you should read.

4.1 Directory View Menu

P, A, G, or N to change the status of the message currently hilighted by the cursor. See 1.2 on page 6 for descriptions of the various status settings.

Right Arrow to see an expanded view of the Subject and Keywords fields.

Left Arrow to return to the normal view.

ENTER to see a quasi-complete display of the message header (PFH).

Up and Down Arrows move the cursor. Page Up and Page Down. To change the display page. [HOME/END coming soon.]

Q to Quit the program, that is to leave PB completely.

M or ESC to return to the Main Menu.

H to see the help screen for Directory View mode.

The function keys are [a first, inflexible implementation of directory display filters:

F1 - to show all directory entries.

F2 - show only those entries with your call or alias in the To field.

F3 - show only those entries with "all" in the To field.

F4 - show only spacecraft log files (AL, CP, etc.). [Not 100% filtered.]

F5 - show Downloaded messages

F6 - show Automatic and Priority messages

F7 - show Grab, Automatic and Priority messages

4.2 Main Menu

Download: Priority Auto Grab Never Fill Dir Info. View dir. Quit! Help.

4.2.1 Priority, Auto, Grab and Never

These operate the same as they do on the Directory View Menu, except that you will be prompted to enter the desired message number. This is primarily used to request messages before you have received their Directory, and is of little use.

4.2.2 Fill

This is a manual command which tells PB to request a particular message from the If you have not yet received any part of the message, Fill will request that the satellite transmit the entire message for you. If you already have part of the message, Fill will request only the missing portions ("holes"). Fill does not alter the message status, and the message will not be automatically completely filled unless it is already marked by the A or P command.

If you want to use Fill instead of allowing PB to operate automatically, type ctrl-A to turn automatic mode off. This will be indicated by "Auto: Disabled" on the Status Bar.

4.2.3 Dir

This sends a directory request to the satellite, to update your directory. This is an immediate, manual command. Generally, the directory will be updated when you run PB, after PB has downloaded any messages with Automatic or Priority status. It is best to let PB automatically update your directory after Automatic and Priority operations are complete, since this gives you the best opportunity to re-use other people's directory entries.

UO-22 Users List rev.27

Uploader: 33 Countries, 244 stations counted (~ Jan.04)

New Access: LU3AIV OH6EH SV8RV 4X6IA WB5UUK ON4DY KC6YPM
C9PRG K5QXJ K4GMP K6DYY W5ERO AA4AC

New Entry and Correction : VK7ZO WB5UUK ON4DY PA3EDN EA3DAN G3CDK
DB2OS 4X6IA EB3CDC KC6YPM ON6UG NM0H

- C9PRG
- CT1DIA
- DB2OS DD1EG DF5DP DL1YDD DL8NCI DF3LZ DL6KG DL1SBY
  DK2SN DL4HBB DK2SM DG3LV DG1EES DL1CR DB5ZP DJ1KM
  DG7BBP DL5DAA DL9CI DG3DBI DL6DBN DG1IAD DL1TV DL0FHF
  DD4YR
- EA2ARU EA2CLS EA4BPN EA3DXR EB3CDC EA3VO EA4QV EB3CBZ
  EA4RJ EA3DAN
- EI6EH EI8FJ
- FO5LQ
- G3YJO G4WFQ G8NOB G0K8KA G0MJW G3RUH G4AXC G8TZJ
  G3PJA G3WGM GB4SFS G3CDK G2BFO G3RWL G7JMK G7JKY
  G4FIP G7HHJ GM4JJJ GM5IHJ G1WTW G6ZRU
- HA5MRC HA5BME
- HB9BOM HB9AQZ HB9XJ HB9BHT
- HL0ENJ
- I2KBD I3RUF IV3IBX I6CGE I0JX IW3QPC IW3QUB IW0CNB
  IT9DLN IV3TKI I6RDM IW3BFC IV3YCQ IW0BFC
- JA6FTL JR1EDE JR1ING JA1OGZ JA1QHQ JH1TWZ JR8XPV JN1ATB
  JL1WJZ JH1AOY JR3FRF JA3JWI JH3FDA
- KF4WQ K8YAH K7PYK K8IRC KA2MOV KC2PH KI6QE KE0VZ
  KD6KQ K4BQH K8TL KN4WZ KC6YPM K5QXJ K4GMP K6DYY
  WC8J WA2LQQ W3QNS WB6YMH WD0E W7KRC W9FMW WB0KSL
  WA9FMQ WD3Q W3GYJ WA4EJR WB5EKW WB9ANQ W2ICZ WA0PTV
  WB9MJN WH6AMX WB5AAA WA5ZIB W2ICZ WB5UUK WA1GPO W0SL
  WB9QKK WJ7F W6SHP WJ9F WD5IVD W3TMZ W5ERO N4HY
  NK6K N6HBB N5AHD N5BF N3FKV N1IJP N8AM N4IRR
  N5KNX NU9H N5KNX N0GIB N4YOE NM0H N4OUL AB4ZX
  AB4KN AA5ER AA4AC
- LA6GH
- LU8DYF LU4AEY LU6DYD LU1EXC LU1WKJ LU1NN LU7AKC LU1NET
  LU3AIV
- OH2SN OH2YU OH6KG OH1KH OH2NRG OH2GV OH1NHW OH6EH
- ON6UG ON5PV ON4KVI OT4SAT ON4DY
- PE1CHL PA3DVG PE1HML PE1DNA PA0BJE PA3EDN PA3AZK
- PY2BJO PU1JTE
- SM5BVF SM0TER
- SV1IT SV3KH SV8RV
- UA3CR RK3KP
- VE4XOR VE6BJH VO1XC VE8DX VE3CDX
- VK2BKQ VK3DTO VK5AGR VK7ZBX VK6BMD VK6VV VK5HI VK2XLG
  VK3DFI VK2AIT VK3ZBB VK3JAV VK3CFI VK7ZST VK7YAO VK3YLV
  VK3AHJ VK2ZAZ VK4CJO VK7ZO
- WP4XQ
- 7YN1UNI
- ZL1AOX ZL1TRE ZL1TJK ZL1WN ZL2AMD ZL2TPO ZL1TDW ZL2UFW
- ZS5NO ZS1ABM
- Z21HJ
- 4X6IA
- 5H3FE
- 9H1EY
- 9J2KL 9J2KP

Table 2 **Compiled by JA6FTL** **01-04-1992**

UO-22 USERS INFO (159 entries Jan.04)

CALL	name	MODEM	ANT dwnlnk	RX dwnlnk	ANT trak	uplnkPWR	
Grid Lo	HM-BBS	TNC	ANT uplnk	TX uplnk	Freq trak	CPU	remarks*
AA2AC	Vern	DSP-12	2x12 RHCP	FT-736R	KCT	25W	
	-	-	2x10 RHCP	FT-736R	KCT-Tune	286 6MHz	
AB4KN	George	MFJ9600	KLM 18C	FT-780	MANUAL	70W	
	KB4EUX	MFJ1278	KLM 14C	TR-751	MANUAL	AT 286	
DB2OS	Peter	G3RUH	2x20 XY Maspro	TS-811E	OSCAR-ST	<50W	
	DK0MAV	TNC2S	2x12 XY Maspro	TS-700G	-	AT286 16MHz	
DK2SM	Ulrich	G3RUH	2x20 XY Maspro	TR-851E	Manual	25W	
	DK0MAV	TNC2C	2x12 XY Maspro	TR-751E	Manual	XT V30 8MHz	
DD1EG	Det	G3RUH	20 ele Maspro	IC-471H	AMSAT-DL	<25W	
	DB0IZ 1	HB-SCC	12 ele Maspro	FT-290 R II	HB	AT286-12MHz	
DF3LZ	Roland	G3RUH	2x19 XY	C500	KCT	10W	
	DB0OQ	TNC2C	2x12 XY	TS-700	-	AT386/387sx	
DF5DP	Bert	G3RUH	2x20 XY Maspro	FT726R	KCT	-	
	DB0IZ	TNC2A	2x12 XY	IC-475H	-	AT386 33M	
DG1EES	Stephan	G3RUH	Triband vert.	FT-736	Fixed	25W	
	DB0IZ	TNC2DL	HB9CV	FT-736	HB	AT386/387SX	
DG3LV	Tobias	G3RUH	2x20 XY Maspro	BelcomLinr70a	Manual	40W	
	DB0HB	TNC2DL	2x12 XY Maspro	ICOM IC-202	30KHz IF	AT-clone+NET	
DG7BBP	Jens	G3RUH	11 YAGI(Flexa)	FT-780	MANUAL	20W	
	DB0CL	MFJ1270	Vert.	TR-9130	-	ATARI ST	
DL1CR	Kurt	G3RUH	2x20 XY MASPRO	FT-736R	AMSAT-DL	<30W	
	DB0HB	TNC2C	2x12 XY MASPRO	FT-736R	-	ATARI MEGA	
DL1YDD	Hart	G3RUH	2x7 3M BOOM	FT-780R+AMP	HB TSR	100W	
	DB0IZ	TNC2C	2x16 3M BOOM	FT-480R	-	386/387 33MHz	
DL1SBY	Axel	G3RUH	2x12 XY RHCP	IC-275	MANUAL	20-40W	
	DB0IE	TNC2C	2x20 XY RHCP	IC-475	-	AT 12MHz.	
DL1TV	Gerhard	G3RUH	12 XY CP	IC-451E	KCT emul	<50W	
	DB0HB	TNC2S	10 XY CP	Semco-Terzo	-	COMPAQ 386s	
DL5DAA	Werner	G3RUH	2x13 Ele vert.	FT-726R	DL1YDD	100W	
	DB0IZ 1	TNC2DL	2x7 eLE vert.	FT-726R	-	AT286 20MHz	
DL6KG	Hans	G3RUH	4x12 ele.horiz	FT-726R	MirageMTI	<25W	
	DB0IE	TNC-2	2x9 ele XY	TS-711E	DG3CAN AFC	AT286 16MHz	
DL6DBN	Frank	G3RUH	2x11ele RHCP	FT-790RII+amp	SAT-TRAX	100W(EIRP)	
	DB0SGL	TNC2c	2x7ele RHCP	FT-290RII+amp	-	Atari-ST	
DL8NCI	Matt	G3RUH	17 ele vert.	FT-726R	Z80 SBC	10/100W	*
	DB0GE	TNC-2	7 ele vert.	FT-726R	MANUAL	80286	
EA2ARU	JABI	G3RUH	2x19 XY TONNA	TS-790S	KCT	45W	
	EA2RCG	TNC-2	2x14 XY TONNA	TS-790S	-	AT286 12MHz	
EA2CLS/	Tom	G3RUH	KLM 435-40CX	TS-790A	KCT/	45W	
kb7hta	EA2CDN	PK-88	KLM 2M-22C	TS-790A	-	AT386 33MHz	
EA3VO	Javier	G3RUH	2 HELIX	TS-790E	KCT	25W	
	-	TINY2	ARAKI 10XY	TS-790E	-	SANYO 386SX	
EA3DAN	JUANp	G3RUH	2x21 XY	FT-736R+amp	KCT	50W	
	EA3RDG	TNC-2	2x10+10 XY	FT-736R	AUTO	AT286 12MHz	
EB3CBZ	Tino	G3RUH	2x19 XY	FT-736R	KCT	25W	
	EA3RDG	TINY2	2x10 XY	FT-736R	Manual	AT286 12MHz	
EB3CDC	Josep	G3RUH	2x88 HB	FT-726R+amp	KCT	50W	
	EA3RDG	TNC-2	2x10+10 HB	FT-726R	AUTO	386SX 20MHz	
EA4RJ	Rafael	NB-96	6 ele Hor	TR-851E	-	25W	
	EA4URE	TNC-2	5 ele Hor	TS-711E	-	AT286 16MHz	

CALL	name	MODEM	ANT dwnlnk	RX dwnlnk	ANT trak	uplnkPWR	
Grid Lo	HM-BBS	TNC	ANT uplnk	TX uplnk	Freq trak	CPU	remarks*
EI6EH	Tom	G3RUH	KLM 40CX	FT736R	KCT/QT	20W	
	EI6EH	TNC2	KLM 22C	FT736R	MANUAL	AT386/20MHz	
FO5LQ	Alain	NB96	2x9 RHCP Tonna	FT736R	KCT	< 60W	
	KB6RAA	TNC2	2x19RHCP Tonna	FT736R	-	AT 386SX	
G3PJA	Fred	G3RUH	2x14 skewed CP	IC-970E	KCT/QT	25W	
	GB7HJP	Tiny2	2x6 skewed CP	IC-970E	KCTuner	AT286 12MHz	
G3CDK	Roddy	-	11ele XTONNA	FT-736R	SATTRACK	-	
	-	Tiny2	16T HelixRHCP	FT-736R	SATTRACK	286 12MHz	
G3RUH	James	G3RUH	16t helix RHCP	FT-736R	HB Auto	<25W	
	GB7DDX	TNC2C	10ele XY RHCP	FT-736R	CAT	AT286-12MHz	
G3RWL	Richard	G3RUH	12 XY	IC-471	MANUAL	100W	
	GB7HSN	TNC2C	10 XY	IC-251	MANUAL	AT286 8MHz	
G3WGM	Jim	G3RUH	9T RH Helix	FT-736R	HB	40W	
	GB7SIG	mPower	5ele XY	FT-736R	HB viaCAT	AT/286	
G4AXC	Peter	G3RUH	10 ele XY	FT-736	MANUAL	25W	
	PLYBBS	TINY2	10t Helix	FT-736	MANUAL	286	
G4FIP	Ken	G3RUH	2x20 XY Maspro	FT-736R	KCT	<25W	
	GB7CYM	DRSI	2x12 XY Maspro	Ft-736R	-	AT286 16MHz	
G4WFQ	Dave	G3RUH	MBM88EL	FT736R	MANUAL	25W	
	GB7HXA	TNC220	KLM14C	FT736R	FIX	PC286 8MHz.	*
G7JMK	Steve	G3RUH	12ele XY RHCP	FT-736R	KCT	<25W	
	GB7XJZ	TNC2C	10ele XY RHCP	FT-736R	CAT	AT286-16MHz	
G8TZJ	Andrew	G3RUH	17 el XY RHCP	IC-471E	HB VIC-20	60W	
	GB7FCI	TINY2	6 el XY RHCP	IC-211E	HB AFC	8086 8MHz	
HA5MRC	Sanyi	NB96	2x14 XY	Conv.+FR-101	MANUAL	50W	
	HA5OB	TNC2	2x9 XY	FT-225+ PA	MANUAL	XT 8 MHz	
HA5BME	Zoli	HB	2x14 XY	Conv.+FR-101	MANUAL	50W	
	HA5OB	TNC2	2x9 XY	FT-225+ PA	MANUAL	XT 8 MHz	
HB9AQZ	Hans	G3RUH	16t Helix	FT-780R+Amp	KCT	<25W	
	HB9OS	MFJ1270	2x10 XY	TR-751E	Manual	AT286 8MHz	
HB9BOM	Roland	G3RUH	20ele XYMaspro	FT-736	SAT TRACK	20W	*
	DB0CZ	TNC2	12ele XY	FT-736+amp	-	80286	
I0JX	Tony	G3RUH	21ele XY	FT736+GaAs	HB	160W	
	-	TNC2	11ele XY	FT736+B1016	Manual	386 33MHz	
IW0CNB	Max	G3RUH	21ele horiz.	FT-736&pre A	MANUAL	25W	
	IR0RMT	TNC2	2x10 XY Cushcr	FT-736	MANUAL	386/387 20M	
I3RUF	GINO	G3RUH	1x21 orriz	TS-790E	KCT	50W	
	I3YPJ	TNC200	1x16 orriz	TS-790E	-	386/387 33M	
I6CGE	Alfio	G3RUH	2x17+17 ele	FT-736	KCT	<80W	
	I6CGE	MFJ1270	10+10 ele	TS-790	AUTO	286 21MHz	
IT9DLN	Santo	G3RUH	2x20	TR851E	MANUAL	-	
	-	TNC2	2x9	TR751E	MANUAL	AT386 25MHz	
IV3IBX	FULVIO	G3RUH	2x19 XY	TS-790E	KCT	50W	
	IV3PFF	TNC2	2x9 XY	TS-790S	-	386/287 25M	
IV3TKI	ALDO	G3RUH	4x20 XY	TS-790E	MANUAL	40W	
	IV3PFF	TNC2	2x10 XY	TS-790E	MANUAL	286/287 8M	
IV3YCQ	IVO	G3RUH	1x21 Horiz.	TS-790E	KCT	45W	
	IV3AVQ	TNC2	2x11 XY	TS-790E	-	386/33MHz	
IW3QPC	Marco	G3RUH	19ele XY	TS-790E	IT Auto	25W	
	-	TNC2	11ele XY	TS-790E	-	8086	

CALL Grid Lo	name HM-BBS	MODEM TNC	ANT dwnlnk ANT uplnk	RX dwnlnk TX uplnk	ANT trak Freq trak	uplnkPWR CPU	remarks*
IW3QUB	Ferruccio	G3RUH	19ele XY	TS-780E	IT Auto	-	
	-	TNC2	9ele XY	TS-790E	-	8088	
IW0BFC	ALEX	G3RUH	1x21 OR TONNA	TS-790E	MANUAL	40W	
	IK0PED	TNC2	1x11 XY TONNA	TS-790E	-	IBM PS2 55SX	
JA1OGZ	Akira	G3RUH	2x19 XY	FT-780	TrakBox	30W	
	JL1ZIJ	TNC-2	12 XY	TR-9000+amp	TrakBox	5530z-SX	
JA1QHQ	Ehara	G3RUH	F9FT 19 XY*2	IC-371	TrakBox	40W	
	JL1ZIJ	TNC200	F9FT 9 XY	IC-251+amp	TrakBox	Dynabook	
JH1AOY	Masa	G3RUH	2x20 XY Maspro	FT-726	Manual	50W	
	JH1DWU	TNC-22	2x12 XY Maspro	FT-726	HB AFC	286 16MHz	
JH1TWZ	nojyu	G3RUH	2x25 vert	FT-736	MANUAL	50W	
	JL1ZIJ	TNC-20H	2x12 vert	FT-736	MANUAL	DynaBook(XT)	
JR1EDE	Kohjin	NB96	2x15elx4	TS-790S	TrakBox	50W	
	JL1ZIJ	TINY2	2x7elex4	TS-790S	TrakBox	386	
JN1ATB	Norio	G3RUH	19 ele Yagi	-	MANUAL	-	
	JL1ZOD	TNC2	9 ele Yagi	-	MANUAL	Dynabook(XT)	
JL1WJZ	Kazumi	G3RUH	20 XY Maspro	FT-726	MANUAL	30W	
	JL1ZOD	PK-80	12 XY Maspro	TR-9000+amp	MANUAL	Dynabook(XT)	
JR3FRF	Toshi	hbDSP	15ele vert	IC-371	MANUAL	50W	
	-	TNC-2	10ele horiz	TS-700+amp	MANUAL	80286	
JH3FDA	Tomo	G3RUH	12ele XY	FT-736	MANUAL	25W	
	JI3ZAG	TNC200	21ele F9FT	FT-736	MANUAL	NEC PC9801	
JA6FTL	sueo	G3RUH	19 ele XY	TS-790S	TrakBox	50W	*
PL47hj	JA6FTL	TNC-2A	12 ele XY	TS-790S+amp	TrakBox	5530z-SX16M	
JR8XPV	Tango	G3RUH	20 XY Maspro	FT-736M	Manual	25W	
	JR8XPV	TNC222	12 XY Maspro	FT-736M	-	Dynabook(XT)	
KC2PH	Peter	DSP2232	KLM 40CX	FT-736	KCT TRAK	-	
	-	-	KLM 22CX	FT-736+amp	KCT Tuner	-	
KF4WQ	RICK	NB96	OSCAR PACK	TS-790A	TCT TRAK	40W	
	KF4WQ-2	TNC-200	OSCAR PACK	TS-790A	JA6FTL AFC	386SX	
K4BQH	Dick	NB-96	2xKLM 40CX	ICOM 475	KCT	Max 100W	
	K4YZU	TINY2	KLM 22C	ICOM 275	KCTuner	386 25MHz	
KN4WZ	Ron	DSP-12	KLM 22C	FT-736	KCT	25W	
	KN4WZ	DSP-12	KLM 40CX	FT-736	KCTtuner	386SX	
KC6YPM	Ron	DSP-12	KLM 18C+25dbAMP	TS-790R	KCT	<45W	
CM97AI	NOARY-1	DSP-12	KLM 14C	TS-790A	KCT/T&QT	386SX 16MHz	
KI6QE	Dave	NB-96	2x20 XY M2	FT-736R	KCT	100W	
	AA6QD	mPOER2	2x12 XY M2	FT-736R	KCTuner	AT386 25MHz	
K7PYK	Wes	PacComm	2xKLM435-40CX	FT-736R	KCT/QT	125W	
	K7PYK	TNC-2	2xKLM2M-22C	FT-736R	KCTune/QT	386&286	
K8TL	Tom	KANTRON	16ele xynk	FT-736	MANUAL	40W	
	W8BI	DATAENG	5ele XY	FT-736nk	MANUAL	AT286 12MHz	
K8IRC	BART	NB-96	40ele KLM	FT-736	KCT	25W	
	KA0REW	TINY2	20ele Cir.	FT-736	KCT-tuner	XT 10MHz	
K8YAH	RON	NB96	6 ele HORZ	IC-475A	MANUAL	25/200	
	W8CQK	TNC200	4 ele VERT	IC275A+amp	MANUAL	TURBO XT	
KE0VZ	LARRY	NB-96	CUSH A144-20T	FT-736	AUTO	80W	
	WB0GDB	TINY2	CUSH 416TB	FT-736	MANUAL	AT 286	
LA6GH	Nils	G3RUH	2x10 XY CushC	FT736R+LandW	QT +Man	30W	
	LA1Z	PK232	2x 7 XY CushC	FT736R	-	PC 86 4.77M	

CALL	name	MODEM	ANT dwnlnk	RX dwnlnk	ANT trak	uplnkPWR	
Grid Lo	HM-BBS	TNC	ANT uplnk	TX uplnk	Freq trak	CPU	remarks*
LU7NN	Sebastian	NB-96	2 Corner 10db	-	manual	7 W	*
	LU3AGJ	PK88	4ele YAGI vert	FT-480R	-	AT286 16MHz	
LU1EXC	Jorge	NB-96	20 ele vert.	FT-736R	AUTO	150W	*
	LU3AGJ	TNC220	11 ele horiz.	FT-736R	-	AT286 20MHz	
LU1WKJ	Ruben	NB-96	11 ele vert.	IC-371H	AUTO	10W	
	LU1WKJ	TINY2	7 ele vert	FT-227/270rh	-	AT386 33MHz	
N4OUL	Glenn	DSP-12	KLM 2x22C	FT-736	KCT	25W	
	N4OUL	DSP-12	KLM 2x40CX	FT-736	KCTtuner	486	
N4HY	Bob	DSP2232	2x20 KLM	IC-471H	KCT/QT	100W	
	W2EMU-4	DSP2232	2x11 KLM	IC-271H	KCT/QT	Dell 325	
N5KNX	James	NB-96	2x15 XY Telex	FT-736R	MANUAL	25W	
	K5ARH	MFJ1270	2x8 XY Telex	FT-736R	MANUAL	386/20MHz	
N8AM	TOM	2xK9NG	KLM 22C	IC-471A	KCT-286AT	50W	
	NO8M	TNC-200	2xFO22 Rutland	IC-271H	KCT-286AT	XT-10MHz	
NK6K	Harold	NB-96	KLM-40CX	IC-475A	KC Track	<25w	
	WB6YMH	TNC2	KLM-22C	IC-275A	Auto	AT386/387SX	
NM0H	Dale	G3RUH	HyGain 215S	ICOM 970A	MANUAL	25W	
	WB0GDB	TINY2	HyGain 216S	ICOM 970A	MANUAL	286-12MHz	
N0GIB	Russ	NB-96	KLM 40CX	FT-736R	MANUAL	25W	
	N0GIB	TINY2	KLM 22C	FT-736R	MANUAL	286-6 80Meg	
OH2NRG	KRK	G3RUH	2x17 XY CueDee	TS-790A	Auto	45W	
	OH2RBI	OHTNC2	1x10 Homem.	TS-790A	TS-790A	386SX	*
OH1KH	Saku	G3RUH	1x17HOR CueDee	IC970E	Auto	25W	
	OH1RBF	OHTNC2	1x10HOR CueDee	IC970E	Auto dplr	AT386SX	
OH1NHW	Ismo	G3RUH	15ele H CueDee	IC-970 A	Auto	25W	
	OH1RBK	OHTNC2	17ele XY RHCP	IC-970 A	Auto	386SX 16MHz	
OH2GV	Matti	G3RUH	15 el XY RHCP	IC-970A	Manual	20W	
	OH2RBI	OHTNC2	8 el XY RHCP	IC-970A	Manual	AT386 25MHz	
OH2SN	Pate	G3RUH	19 ele XY	IC-490E	Auto	150W	
	OH2RBI	TNC2C	2x9 ele. HOR.	IC-251/Mutek	Auto dplr	386	*
OH2YU	Sirpo	G3RUH	2x17 XY RHCP	FT-736R	Auto PC	20W	
	OH2RBA	TNC-2	2x10 XY RHCP	FT-736R	Manual	386sx 16MHz	
OH6KG	Kennet	G3RUH	7ele XY	IC-230R	Auto	25W	
	OH6RDW	OHTNC-2	9T RH Helix	Salora surlus	Auto l	AT386 25MHz	
ON4DY	BOB	G3RUH	9 el.TONNA	TR-751E	MANUAL	75W	
	ON7RC	TINY-2	19 el.TONNA	TR-9500	MANUAL	386SX 16MHz	
ON4KVI	RENAULD	G3RUH	17ele XY	TS811	MANUAL	100W	
	ON7RC	TNC2S	9ele XY	TS711	MANUAL	PCXT 8MHz.	
ON5PV	PHIL	G3RUH	17ele V-H	FT-726R	MANUAL	40W	
	ON7RC	TNC2S	6ele V-H	TM221E	MANUAL	286 16MHz	
ON6UG	Freddy	G3RUH	2M Dish	FT-736R	HB Auto	80W	
	ON7RC	TNC2C	9 ele XY	FT-736R	DIGITAL	386SX 16MHz	
PA3DVG	AREND	G3RUH	2x17 CD HOR.	FT-736R	KCT	100W	
	PI8JYL	PK87	2x15 CD HOR.	FT-736R	KCT	386 25MHz	
PA3EDN	Egon	G3RUH	2x20 XY Maspro	ICOM 475	AMSAT-DL	<50W	
JO22NA	PI8UTR	SCC8530	2x12 XY Maspro	ICOM 275	HB(PX-8)	AT286 8MHz	
PA0BJE	Jan	G3RUH	KLM 40CX	FT-736R	-	25W	
	-	PK87	KLM 22C	FT-736R	-	Atari1040ST	
PE1CHL	Rob	G3RUH	2x15 XY RHCP	FT-712RH	AMSAT-DL	45W	*
	PI8UTR	HB	2x6 XY RHCP	FT-212RH	HB(PX-8)	Atari520ST	

CALL	name	MODEM	ANT dwnlnk	RX dwnlnk	ANT trak	uplnkPWR	
Grid Lo	HM-BBS	TNC	ANT uplnk	TX uplnk	Freq trak	CPU	remarks*
PE1HML	Hendrik	G3RUH	TURNSTYLE	FT-780	NONE	12W	*
	PI8ZAA	SCC8530	VERTICAL	FT-480	NONE	8MHz PC	
PE1DNA	Joop	G3RUH	19ele Yagi	IC-475	MANUAL(IT)	-	
	-	none	15ele Yagi	IC-275	-	AT clone	*
RK3KP	ClubSTn	NB96	2x20 XY Maspro	FT-736R	KCT	-	*
	RK3KP	TINY2	2x12 XY	FT-736	MANUAL	286	
SMOTER	BRUCE	G3RUH	2M Dish	TX790A	HB 8052	45W	*
	SMOETV	TINY2	2x9 SKEWED CP	TX790A	HB AFC	COMPAQ286	
SM5BVF	HENLY	G3RUH	2x13 skewed	IC-475	KCT	50W	
	SMOETV	TNC200	2x6 skewed	IC-275	HB	386 16MHz	
SV1IT	Kostas	G3RUH	9ele vertical	TR851	MANUAL	25W	
	UOSAT3	TNC-2	19ele vertical	TR751	MANUAL	COMPAQLTE386	
SV3KH	Nick	NB96	2x22ele K1FO	IC-475	MANUAL	25W	
	SV8RV	MFJ1270	2x9ele TONA	IC-275	-	386sx 16MHz	
UA3CR	Leo	G3RUH	9ele F9FT	FT-736	Fixed	-	
	RK3KP	TNC2	Helix 10T	FT-736	MANUAL	XT	
VE4XOR	Bruce	K9NG	T-Style (LH)	R451 Hamtro.	None	30W	
	VE4KV	MFJ1274	T-Style (RH)	Surplus VHF	AFC	286 12MHz	
VE8DX	BOB	NB96	KLM40CX	IC735/convet	KCT	40W	
	-	MFJ1274	KLM22C	ALINCO112	-	XT 10MHzV30	
VE6BJH	Blair	NB96	2x8 XY	TR-851A	MANUAL	25W	
	VE6BJN	TNC220	2x10 XY	TR-751A	-	386 20MHz	
VK2AIT	Geoff	G3RUH	22 ele XY	FT-780R	MANUAL	10W	
	VK2XY	TINY2	12 ele XY	FT-480R	HB AFC	486 33MHz	
VK2XLG	Don	NB-96	2x20 XY Maspro	TR851A	KCT	25W	
	-	-	-	-	MANUAL	386SX	
VK3CFI/	Maggie	G3RUH	Maspro	IC-251A	-	-	*
VK3DFI	VK3JAV	mPOWER2	Maspro	IC-471H	-	T3100E	
VK3DTO	Andy	G3RUH	2x12 XY 18ver	TS-711A	-	-	
	-	mPOWER2	2x11 XY	TS811,IC490A	-	-	
VK3YLV	David	NB-96	1x14 Vert Yagi	IC-490E	MANUAL	45W	
	VK3JAV	TINY2	1x8 Vert Yagi	IC-27H	MANUAL	AT286 12MHz	
VK3ZBB	BOB	NB-96	2x20 XY Maspro	IC-471A	KCT	10W	
	VK3BBS	TINY2	2x12 XY	IC-251A	-	PCS 286	
VK4CJO	Jhon	NB96	2x19 XY	FT-736R	MANUAL	25W	
	VK4WIA	PK232	2x 9 XY	FT-736R	MANUAL	AT386-sx	
VK5AGR	Graham	G3RUH	2x20 XY Maspro	IC-271A	SATTRAK3	25W	
	VK5WI	TINY2	2x12 XY WHS32	IC-471A	MANUAL	AT286 12MHz	
VK5HI	Colin	G3RUH	2x9 ele KLM	TS-700A	MANUAL	10/100W	
	-	TINY2	2x7 ele KLM	TS-811A	MANUAL	386sx 20MHz	
VK6BMD	Bruce	G3RUH	2x19 el vert	IC-471H	MANUAL	25W	
	VK6BBS	FRASH	1x17 el vert	IC-290H	MANUAL	XT 8MHz.	
VK6VV	Arnold	G3RUH	16T Helical	TS-790A	MANUAL	45W	
	VK6BBS	PAD-205	14 ele Vert	TS-790A	JA6FTL AFC	AT286 16MHz	
VK7ZBX	Richard	G3RUH	16T Helix RHC	FT-736R	MANUAL	25W	
	VK7GL	PK-88	10 XY RHC	FT-736R	MANUAL	286 20MHz.	
VK7ZST	Steve	G3RUH	2x14 XY	FT-736R	MANUAL	25W	
	VK7GL	TNC-2	2x8 XY	FT-736R	MANUAL	286 12MHz	
VK7ZO	Graham	G3RUH	6 ELE XY	FT736R	MANUAL	25w	
	VK7GL	TNC320	5 ELE XY	FT736R	MANUAL	10MHz 8088	

CALL	name	MODEM	ANT dwnlnk	RX dwnlnk	ANT trak	uplnkPWR	
Grid Lo	HM-BBS	TNC	ANT uplnk	TX uplnk	Freq trak	CPU	remarks*
W2ICZ	Syd	DSP-12	KLM 40CX	FT-736R	KCT-TRAK	25W	
	Wa0PTV	DSP-12	KLM 20CX	FT-736R	KCT-TUNER	386	
W3GYJ	ROD	NB96	KLM44CX	FT-736R	KCT/QT4.0	25W	
	-	TINY2	CR144-20	FT-736R	KCT-Tuner	386 25MHz.	
W3QNS	BOB	NB96	M2-436-CP30	TS-790A	KCT/MAN	80W	
	N4CCK-2	TINY-2	M2-2MCP22	TS-790A	JA6FTLAFC	386SX 16MHz	
W7KRC	Wally	NB96	KLM44CX	FT-726	XCT/XT	25W	
	WB7ULH	TINY2	KLM22C	FT-726	MANUAL	Laptop12MHz	
W9FMW	Jack	NB96	2xKLM 40CX	IC-475A	Graftrak	100W	
	KA9LQM	TNC200	2xKLM 22C	IC-274A+amp	2xKCT	286 16MHz	
WA2LQQ	Rip	NB96	KLM435-40CX	TS-790A	KCT/GT	45W	
	WA2SNA	TNC-2	KLM2M-22C	TS-790A	KCTune/GT	286 12Mhz.	
WA4EJR	Jack	NB96	KLM-40CX	TS-811A	TrakBox	25W	
	-	TNC2	KLM-14C	TS-711A	TrakBox	386SX 16MHz	
WA0PTV	John	DSP-12	KLM 40cx	FT-736R	KCT	25W	
	WA0PTV	DSP-12	KLM 22c	FT-736R	KCTuner	80386	
WB0KSL	Jhon	DE9600	KLM 18C	FT-736R	KCT	80W	
	WB0AEX	KAN DE	KLM 22C	FT-736R	KCTuner	486 33mhz	
WB5EKW	Howard	NB96	KLM-40CX	TS-790A	KC Track	35W	
	-	Tiny2	KLM-22C	TS-790A	KC Tuner	286 12MHz	
WB5UUK	Rudy	NB96	Hygain 70-30	FT-736R	-	50W	
	N5LKJ	MFJ1270	Hygain 216SAT	FT-736R	-	286AT	
W6SHP	Howard	G3RUH	18ele XY	FT-736R	MANUAL	100W	
	WD6CMU	PK232	14ele XY	FT-736R	MANUAL	286AT 12MHz	
WA9FMQ	Gary	NB96	KLM-14c	TS-790	KCT/QT4.0	-	*
	-	mPOWER2	KLM-22c	TS-790	KCT Tuner	Zeos386sx	
WB9ANQ	Bruce	G3RUH	KLM435-40CX	FT-736R	HB	100W	
	W8BI	TNC-200	KLM2M-22C	FT-736R	MANUAL	286	
WB9MJN	Don	NB96	QFHelix/19elYag	IC-471A	Manual	10W	
	W9IUP	`1270b	18ele Yagi	IC-271A	AFC-Analog	10MHz PC	
WJ9F	Russ	NB-96	2x20 XY KLM	FT-726R	KCT	<50W	
	W4BFB	Micro-2	2x11 XY KLM	FT-726R	MANUAL	AT286 12MHz	
WB6MPQ	Al	NB-96	KLM-40C	FT-736	MANUAL	50W	
	NN2Z.NJ	PK232	KLM-22C	FT-736	MANUAL	386 20MHz	
WC8J	Rich	G3RUH	20ele RH-XY	ICOM 471H	HB + IT	-	
	-	1270B	40ele XY	ICOM 275H	-	286 16MHz	
WD3Q	Eric	NB96	KLM-14c	TS-790	KCT	-	*
	-	mPOWER2	KLM-22C	TS-790	KCT-tuner	Zeos386sx	
WH6AMX	Rick	NB96	KLM 40CX	ICOM 451A	KCT/IT	100W	
	KH6GPI	TINY2	KLM 14C	ICOM 271A	MANUAL	8088 8MHz	
W0SL	ROY	NB-96	KLM-18C	IC-475H	KCT	100W	
	K0PFX	TNC200	KLM-16C	IC-275H	KCTuner	386 25MHz	
WB0KSL	John	NB-96	KLM 18C	FT-736R	KCT	80W	
	WB0AEX	TINY2	KLM 22C	FT-736R	KCTuner	286 8MHz	
WP4XQ	Ramon	MFJ9600	KLM 22C	FT-736R	MANUAL	25W	
	WP4XQ	MFJ1278	KLM 40CX	FT-736R	MANUAL	386SX 16MHz	
ZL1AOX	Ian	G3RUH	15T HELIX RHC	IC-475H	MANUAL	<75W	
	ZL1AB	MFJ1270	KLM22C,5/8COLI	IC-275H	MANUAL	XT 10MHz	
ZL1TDW	Eric	NB-96	2x10 XY	FT-736	Manual	25W	
	ZL1AB	TINY2	2x10 XY	-	-		

```
CALL    | name  | MODEM | ANT dwnlnk     | RX dwnlnk     | ANT trak | uplnkPWR    |
Grid Lo| HM-BBS| TNC   | ANT uplnk      | TX uplnk      | Freq trak| CPU  remarks*

ZL1TRE | Mark  | G3RUH | KLM40CX        | TS-811A       | MANUAL   | 25W         |
       | ZL1AB |MFJ1270| KLM22C         | TS-711A       | MANUAL   | 386 26MHz   |
ZL1TJK | Jim   | G3RUH | 24ele JbeamVer| TR851a/726R | MANUAL   | 10W         |
       | ZL1UX |MFJ1270| 6ele Yagi Ver  | FT726R        | MANUAL   | 386/387 16M|
ZL1WN  | Ros   | NB-96 | KLM-40CX       | FT-736        | KCT      | 30W         |
       | ZL1AB |MFJ1270| KLM-22CX       | FT-736        | -        | AT386 33MHz|
ZL2AMD | Dave  | G3RUH | 2xKLM435-40CX  | FT-736R       | KCT/QT   | 60W         |*
       | ZL2AMD| TINY2 | 2xKLM2M-22C    | FT-736R       | -        | AT386 33MHz|
ZL2TPO | Chris | G3RUH | 1x14 vertical  | FT-736        | KCT      | 25W         |
       | ZL2WA | Tiny2 | 1x10 vertical  | FT-736        | KCT      | 386 33MHz   |
ZL2UFW | Terry | NB-96 | M2 436-CP30    |FDK multi750a| HB card  | -           |
       | ZL2AB | TINY2 | M2 2M-CP14     | IC-251a+amp | -        |AT386sx16MHz|
ZS1ABM | GERD  | NB-96 | 2x19 V         | IC-451        | MANUAL   | 10W         |
       | ZS1IT | TINY2 | 2x10 V         | IC-251        | HB       | 386 27MHz   |
ZS5NO  | Ian   | G3RUH | 16T Helix RHCP| IC-451E       | MANUAL   | < 40W       |
       | ZR5GQ |MFJ1278| 11el YAGI Vert| IC-251E       | MANUAL   | AT286 12MHz|
4X6IA  | DAVID |4X6IA  | KLM 18C        | TS140+CONV    | MANUAL   | 40W         |
       | 4X1RU | PK232 | KLM 14C        | STANDARD      |MODEM CONT| XT V20 10MH|
5H3FE  | HENLY | G3RUH | 3el XY JAYBM   | WD 70FM+ARR   | FIXed    | 35W         |*
       | -     | TINY2 | 3 TURN HELIX   | WD 144FM      | AFC      | PS255 16MHz|*
9H1EY  | John  | G3RUH | 2x16 XY H/BREW| TS-790E       | MANUAL   | 35W         |
       | None  | TINY2 | 2x8  XY H/BREW| TS-790E       | MANUAL   | XT 8MHz     |
```

Remarks
DL8NCI : usingg own ftl0 s/w; Z80 based single board computer as tracker.
G4WFQ : No need doppler tracking with wide IF filter (CFW445B:6dB BW 30KHz)
HB9BOM : SAT TRACK=> 8052AH tracker
JA6FTL : TrakBox=>8052 based standalone multi purpose board (PCB kit available)
LU1EXC : HB 8052AH tracker
LU1NN : LU1NET:Adrian
OH2NRG : AFC Doppler based RX freq control
PE1CHL : developing PACSAT s/w for Atari ST&PC,TCP/IP PE1CHL version with FTL0
PE1HML : Using NET TCP/IP with ftl0 by PE1CHL
PE1DNA : No TNC's 2*OPtoPcScc card by PA0HZP (4 8530s)
RK3KP : Amsat-U-Sputnik.Club Stn of Center of Science & Technology for Youth
SM0TER : Home Brewed 8052AH antenna control board(document are on this board)
VK3CFI : CFI:Maggie, DFI:Lou
WD3Q/WA9FMQ : VITA station in Rosslyn,VA,Washington.DC
OH2SN : rx freq controled by 1khz steps with freq.calclat. tracking program
ZL2AMD : International Packet Gateway. fsk/psk 40,30,15,10m.
5H3FE : VITA station,University of Dar es Salaam,Tanzania.
4X6IA : Self designed 9.6kmodem,RX freq. tune controled from modem board
----
PLEASE give me your comment about this format and send your station
information with above form via UO-14/AO-16/FO-20.IF you have general remarks,
Pse inform me within one line.

73s   SUEO ASATO   JA6FTL @ja6ftl.jnet6.jpn.asia

AMSAT Area Coordinator Roster

CALL	*NAME*	*ADDRESS*		*PHONE*
CALL AREA 0				
K0BI	James Roop	PO Box 255	Allegan, MI 49010	616-673-2093
K0GA	Garfield Anderson	5820 Chowen Ave. S.	Edina, MI 55410	612-922-1160
K9MWM/0	Bob Ludtke	406 Yale Circle	Glenwood Spring, CO 81601	303-945-8722
KA0YOS	Joe Mayfield	1100 Calle Del Encan	Las Cruces, NM 88005	505-523-8958
KB0SW	Gary Hanson	Route 1 Box 364	Collbran, CO 81624	303-487-3233
KF0BH	Thomas McIntire	1014 S. 9th Ave.	Marshalltown, IA 50158	515-753-6263
N0ERC	David DeVries	100 O'leary Lane	Rock Rapids, IA 51246	712-472-2764
W0CY	Jim McKim	1721 Glen Avenue	Salina, KS 67401	913-827-2927
W0EOZ	Art Jensen	411 3rd Street S.E.	Jamestown, ND 58401	701-252-3769
W0IT	Stan Burghardt	315 10th Ave. N. W.	Watertown, SD 57201	605-886-3737
W0QIN	Robert Clark	7701 Glasgow Drive	Edina, MN 55439	612-944-1315
W0SL	Roy Welch	908 Dutch Mill Drive	Manchester, MO 63011	314-391-1127
W0ZZQ	Max Bodenhausen	HCR 1 Box 643	Highlandville, MO 65669	417-587-3690
WB0NCR	Richard Machacek	3185 240th Street	Winthrop, IA 50682	319-935-3699
WB0P	David Stephens	Box 6365	Denver, CO 80206	unknown
WD0AKO	Dale Cary	3012 18th Street S.	Moorhead, MN 56560	218-236-6324
WD0E	Jim White	6642 S. Dover Way	Littleton, CO 80123	303-979-3605
WD0HHU	David Cowdin	8325 S. Yukon Street	Littleton, CO 80123-6144	303-972-0648
CALL AREA 1				
KA1M	Drew Deskur	19 Parker Drive	North Reading, MA 01864	508-644-0006
KA1NRC	John Fast	6 Jean Drive	Old Lyme, CT 06371	203-434-8361
W1HUM	Dana Tremblay	216 High Range Road	Londonderry, NH 03053	603-432-0748
W1JSM	Donald Browm	638 Post Road	Greenland, NH 03840	603-436-6745
W1NU	Vic Politi	69 Flax Road	Fairfield, CT 06430	203-259-4655
WA1DMV	Bill Polewarczyk	59 Birch Street	Derry, NH 03038	603-452-5368
CALL AREA 2				
N2LDR	Marty Miller	PO Box 754	Philmont, NY 12565	518-672-7344
W2RS	Ray Soifer	60 Waldron Court	Glen Rock, NJ 07452	201-447-5472
WA2EXJ	Randy Baker	PO Box 144	Madison, NY 13402	315-893-7194
WA6ERB	Bob Gobrick	Box 1591	Champlain, NY 12919	unknown
WB2IBO	Harry Morton III	261 N Chestnut St.	N. Massapequa, NY 11758	516-541-1783
WB2MNF	Jon Pearce	109 Pine Cone Trail	Medford, NJ 08055	609-953-1677
CALL AREA 3				
K3JL	John Low	Rt 2 Box 244G	Georgetown, DE 19947	302-856-2307
K3PTQ	Millard Croll, M.D.	435 Hughes Road	Gulph Mills, PA 19406	215-964-0422
KA3VGD	Dave Haben	52 Holly Forest Rd.	Mt. Pocono, PA 18344	717-839-6795
CALL AREA 4				
AB4IF	Jim Donelson	3169 Mariner Way	Lantana, FL 33462	407-967-4560
AB4KN	George Daniel	401 Whitfield Court	Peachtree city, GA 30269	404-487-0208
K4BQH	Dick Schiller	5809 Summit View	Crestwood, KY 40014	502-222-0586
K4EDU	Roy Robinson	3058 Angela Street	Augusta, GA 30907	404-860-6971
K4SR	Richard Bishop	305 Lakewood Drive	Moneta, VA 24121	703-297-5550
KA4UFM	David Miracle	2083 Quilt Court	Lithonia, GA 30058	unknown
KA5SMA/4	Mike Miller	449 Robin Hood Drive	Sevierville, TN 37862	615-428-5415
KB4LCI	David Gordon	PO Box 154	Green Bank, WV 24944	304-456-4224
KC4BQX	John Coons	1662 Faxon Road	Memphis, TN 38112	901-274-1807
KE4ZV	Gary Coffman	534 Shannon Way	Lawrenceville, GA 30244	404-963-8363
KG6EX/4	Gene Pentecost	2017 Cedarmont Drive	Franklin, TN 37064	615-794-3496
KJ4BF	Lee Barnett	517 Wagon Trail Road	Simpsonville, SC 29681	803-967-3963
N4CU	Bob Walker	6601 SW 16th Street	Plantation, FL 33317	305-792-7015
N4IFD	Mike Crisler	17514 SW 83rd Court	Miami, FL 33157	305-378-9971
N4IRR	Mike Zingman	13105 SW 117 Terrace	Miami, FL 33186	305-382-9554
N4KHG	Mike Callihan	9905 121st Court	Seminole, FL 34642	813-398-4060
N4MW	Dave Meier	3205 Covington Pike	Memphis, TN 38128-5017	901-382-4919
N4PLY	John Kuklinski	20120 SW 83rd Ave	Miami, FL 33189	305-255-6318
N4RAR	James Penland	2961 Lavista Court	Decatur, GA 30030	404-636-1000
N4SXM	Charles Preston	2285 Tally Drive	Chamblee, GA 30341	404-455-8147
W3PM/4	Gene Marcus	917 Chatterson	Huntsville, AL 35802	205-880-1237
W4BIW	Byron Lindsey	1356 Vista Leaf Dr.	Decatur, GA 30033	404-636-7452
W4DAQ	Mack Jordan	PO Box 1027	Demopolis, AL 36732	205-289-1225
W4EWB	Tom Walker	6438 Mtn. Laurel Ln.	Trussville, AL 35173	205-655-8914
W4FJ	Ted Mathewswon	1525 Sunset Lane	Richmond, VA 23221	804-355-5118
W4OCW	Ken Wilhoit	153 Stone Mill Lane	Marietta, GA 30064	404-428-4913
W4QAU	Edward Stluka	2802 Brett Road	Huntsville, AL 35810-3307	205-852-3850
W4TZU	Sherman Starnes	Route 1 Box 99	Franklinton, NC 27525	919-494-5169
WA4GSS	Ron Curry	229 W. Greenhill Rd.	Ashland, KY 41101	606-928-6672
WA4SXM	Gould Smith	8008 Chesterfield Dr	Knoxville, TN 37909	615-691-2718
WB4URU	Henry Fitz	3354 Kegler Drive	Jacksonville, FL 32216	904-737-3569
WB4ZXS	John McDonald	1511 Pineda Street	Cocoa, FL 32922	407-632-6669
WB5PMR/4	Al Brinkerhoff	7357 Woodknot Drive	Orlando, FL 32811	407-290-8419
WB9OEP/4	Steve Park	12122 99th Ave. N.	Seminole, FL 34642	813-391-7515
WD4ASW	Barry Baines	4398 Phillips Place	Jacksonville, FL 32207	904-398-5185

WD4NAE	Don Adams	318 North Hampton Rd	Leesburg, GA 31763	912-438-7943
WD4PQN	Albert Forte III	9302 Spring Terrace	Ocala, FL 32672	904-687-1518
WJ9F/4	Russel Platt	4226 Peppertree Ave.	Concord, NC 20025	704-784-4949

CALL AREA 5

KA5DNP	Jack Douglas	2019 Willow Point Dr	Kingwood, TX 77339	713-358-5172
KA5RMT	R.G. Maniago, M.D	12 Country Club Road	Vernon, TX 76384	817-553-1447
KA5TUQ	Don Schexnailder	7031 Roos Street	Houston, TX 77074	713-771-0618
KG5OA	Doug Howard	2517 Coldstream Dr.	Fort Worth, TX 76123	817-292-6440
KT5U	Rusty Reeve	165 Santa Fe Trail	Lucas, TX 75002	214-442-1217
N5EM	Ed Manuel	10,430 Sagevale	Houston, TX 77089	713-481-6801
N5NSL	Ed Smith	705 NW 16th Street	Oklahoma City, OK 73103-2111	unknown
NC5Y	George Tew	1209 Springdale Dr	Jackson, MS 39211	601-956-4724
W5DSG	Harold Bulmahn	Rt. 1 Box 291	Waco, TX 76712-9702	817-848-5123
W5GEL	Robert Douglas	3435 Floyd Street	Corpus Christi, TX 78411	512-852-2208
W5IU	Keith Pugh	PO Box 121576	Fort Worth, TX 76121	817-292-5633
W5VZF	Jim Akers	21 Whispering Pines	Starkville, MS 39759	601-323-8389
WA5WHN	Jay Miller III	4613 Jupiter Street	Albuquerque, NM 87107	unknown
WA9PZL/5	Roger Ley	2514 Deas Street	Bossier City, LA 71111	318-746-0356
WB5HLZ	R. Burns Cleland	Box 310318	New Braunfels, TX 78131-0308	unknown
WB5UUK	Rudy Hardy	2523 Pomeran	Houston, TX 77080	713-462-5320
WB5ZDP	Keith Berglund	2936 Elisnor Drive	Fort Worth, TX 76116	817-244-5176
WD5GLD	Richard Ruhl	RT 1 Box 105-RR	Kingfisher, OK 73750	405-375-4843

CALL AREA 6

AA6NP	Gene Davies	3450 Ben Lomond Pl.	Los Angeles, CA 90027	213-662-2820
AB6FL	Tim Bosma	913 Strathmore Dr.	Modesto, CA 95355	209-524-5653
KH6JRB/6	Gary Nakayama	1929 Bayview	Belmont, CA 94002	415-591-4896
N6DBF	John Wisiowski	1706 Roanoke Street	Placentia, CA 92670	714-524-7343
N6SMZ	Bill Rauch	11349 Candor Street	Cerritos, CA 90701	310-809-1933
N6VLV	Paul Johnson	309 N. GrandAve.	Monrovia, CA 91016	818-357-8448
W6HDO	Clifford Buttschardt	950 Pacfic Street	Morrow Bay, CA 93442	805-772-2132
WA6AMW	Bob Dalleske	Box 220	McCloud, CA 96057	916-964-3154
WA6YDI	David Smith	1050 E. Herndon #132	Fresno, CA 93720	209-432-1838
WB6LLO	Dave Guimont	5030 July Street	San Diego, CA 92110	619-275-1495
WB6OVH	Gordon Fuller	7756 Tobia Way	Fairoaks, CA 95628	916-961-0576
WH6AMX	Rick Dittmer	7305d Aloalo Street	Honolulu, HI 96818	808-423-8772

CALL AREA 7

AL7JM	Mike Bennett	12303 woodward Dr.	Anchorage, AK 99516	907-345-3486
K7SFN	Frank Dziurda	225 W. Coyote Drive	Carson City, NV 89704	702-849-1841
KA7LDN	Joe Holman	22909 NE 24th Place	Redmond, WA 98053	206-868-1040
N7LVK	Hank Burroughs	1712 NW Nye Street	Toledo, OR	503-336-5259
N7NQM	Gary Beaver	15801 N. 30th Drive	Phoenix, AZ 85023	602-993-8288
N7QOC	Paul Urie, MD	622 East 3180 North	Provo, UT 84604-4200	801-374-6036
NW7N	Larry Brown	2721 S. Black Moon	Tucson, AZ 85730	602-886-1957
W7KRC	Wally Nelson	PO Box 394	Bountiful, UT 84010	801-298-5390
W7RZY	Harry Roylance	216 So. M. Street	Livingston, MT 59047	406-222-0655
WD4ECK/7	Stuart Mitchell	3030 El Dorado	Medford, OR 97504	503-770-2835

CALL AREA 8

K8MU	Larry Koziel	25820 Fortuna	Roseville, MI 48066	313-777-9524
KB1ISF/8	Keith Baker	1324 Fairgrounds Rd.	Xenia, OH 45385	513-429-5325
N8GLE	Charles Fitzsimmons	662 Mull Avenue 2C	Akron, OH 44313	216-864-8629
WA8BYD	Jerome Marchal	2049 Buford Bard Rd.	Mt. Orab, OH 45154	513-446-3074
WA8CWD	Larry Reitz	26785 Tracey Road	Walbridge, OH 43465	unknown
WA8LAJ	Jerry Moore	114 Saint Francis	Tiffin, OH 44883	419-447-8920
WB8IFM	Gerd Schrick	4741 Harlou Drive	Dayton, OH 45432	513-253-3993
WB8ZTV	D. E. Knollinger	RD 4 Box 230	Moundsville, WV 26041	304-845-1301
WB9ANQ/8	Bruce Rahn	410 Coronado Trail	Enon, OH 45323	513-864-5803

CALL AREA 9

K9NO	Paul Bocci	23W732 W. Pine Ave.	Roselle, IL 60172	708-351-5213
K9PVW	K. O. Learner, II	PO Box 5014	Kokomo, IN 46904	317-453-2947
KA9BNR	Dave Mayfield	2205 Barnard Court	Moline, IL 61625	309-797-3824
KA9LNV	Ed Krome	1023 GoldfinchRd.	Columbus, OH 47203	812-379-9433
KB9CML	Jon Haskell	10906 Lakeshore Dr.W	Carmel, IN 46032	317-846-5880
KD9QB	Ron Pogue	210 Westminster Dr.	Noblesville, IN 46060-4242	317-773-4936
KE9I	Gerard Jendraszkiew	5459 W. 83rd Place	Crown Point, IN 46307	219-738-2728
KIFJ/9	Frank Jaworski	3923 Oakleaf Dr.	Fort Wayne, IN 46815	219-485-2634
N9EP	Ed Pichas	604 Hawthorne Lane	Carpentersville, IL 60110	708-428-3645
N9EZV	Ken Tendick	poo Box 681382	Schaumburg, IL 60168	312-980-5530
N9HR	Tom Wrensch	N7900 Hillcrest St.	Oconomowoc, WI 53066	414-567-7382
N9NLE	Don Bryant	37 Pine Street	Carpentersville, IL 60110-1605	708-428-2195
ND9T	Tim Kearney	6421 Wayoata Court	Fort Wayne, IN 46815	219-485-9651
NJ9Y	Chuck Pocius	1036 E. Paddock	Plantine, IL 60067	708-991-8618
W9MXC	Larry Roberts	5319 Dover Drive	Godfrey, IL 62035	618-466-0041
WA9KNP	Brad Pioveson	301 Kirsch Street	Benton, IL 62812	618-439-3702
WB9QPG	David Filmer	PO Box 2077	West Lafayette, IN 47906	317-463-6618
WD9HSY	Brian Bedoe	11248 Marilyn Way	Mokena, IL 60448-9411	815-469-1383

[illegible] [illegible] [illegible] you have a hard drive [illegible] please perform the following [illegible]:

1. Make a backup copy of this disk!

2. Make a subdirectory on your C: drive called "PBG" (C:MD PBG)

3. Change directories and go into that subdirectory.(C:CD\PBG)

4. Using DOS copy all the files on this diskette into the PBG subdirectory. (C:\PBG>COPY A:*.*)

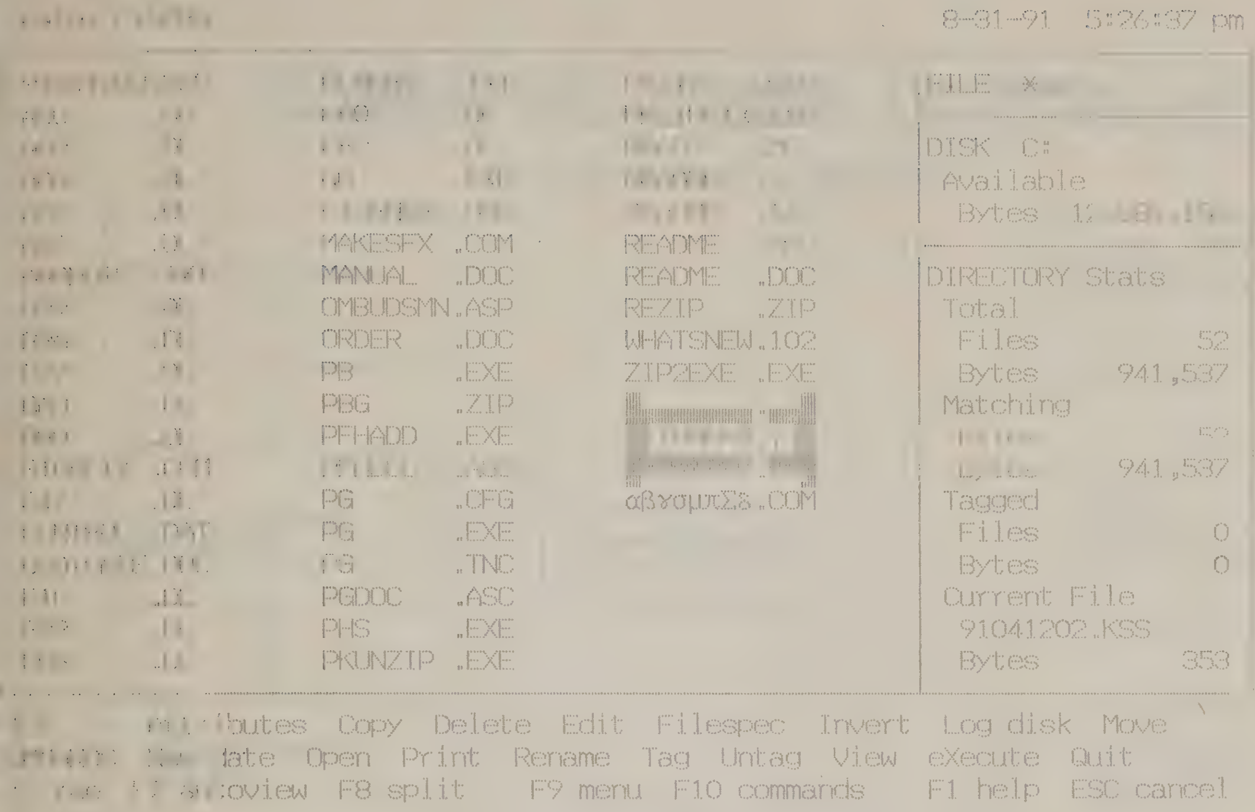
5. Type in "PKUNZIP -d pbg.zip" Note: the case of this entry matters. Be very careful to add the "-d" IN LOWER CASE or the subdirectories described in the text won't be included.

6. Hit the "enter" key and watch the subdirectories fill up.

7. Go back to the text for further instructions.

Call me if you have any trouble

[illegible]



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[illegible]                                              8-31-91  5:26:37 pm

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[illegible]     [illegible]        [illegible]          DISK  C:
[illegible]     [illegible]        [illegible]           Available
[illegible]     [illegible]        [illegible]            Bytes  [illegible]
[illegible]     MAKESFX  .COM      README   [illegible]
[illegible]     MANUAL   .DOC      README   .DOC        DIRECTORY Stats
[illegible]     OMBUDSMN.ASP       REZIP    .ZIP         Total
[illegible]     ORDER    .DOC      WHATSNEW.102           Files          52
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[illegible]     PBG      .ZIP      [illegible]           Matching
[illegible]     PFHADD   .EXE      [illegible]            Files          52
[illegible]     [illegible]        [illegible]            Bytes     941,537
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[illegible]     PKUNZIP  .EXE                             Bytes         353

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[illegible] [illegible]date  Open  Print  Rename  Tag  Untag  View  eXecute  Quit
[illegible] [illegible]oview  F8 split    F9 menu  F10 commands    F1 help  ESC cancel
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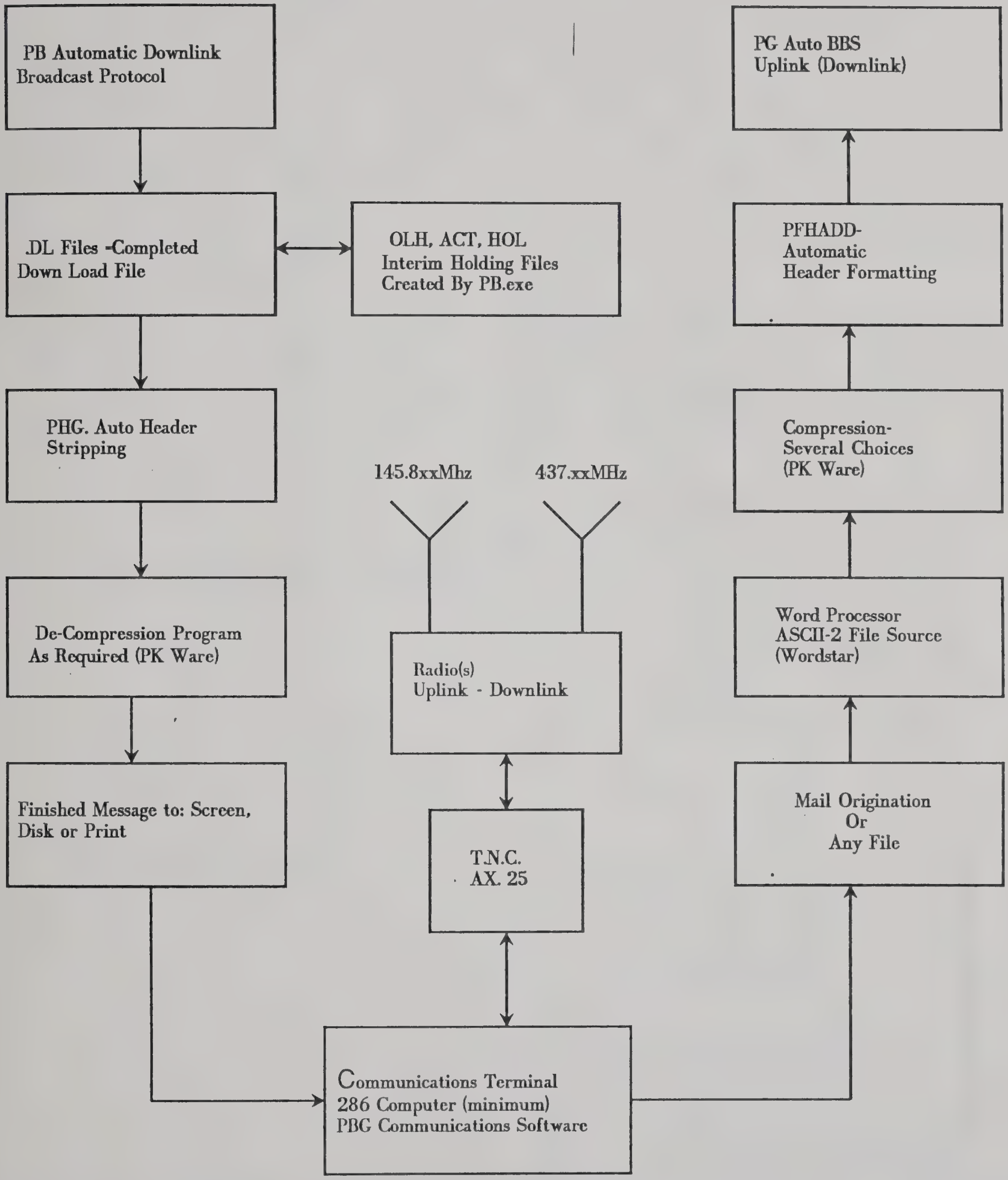
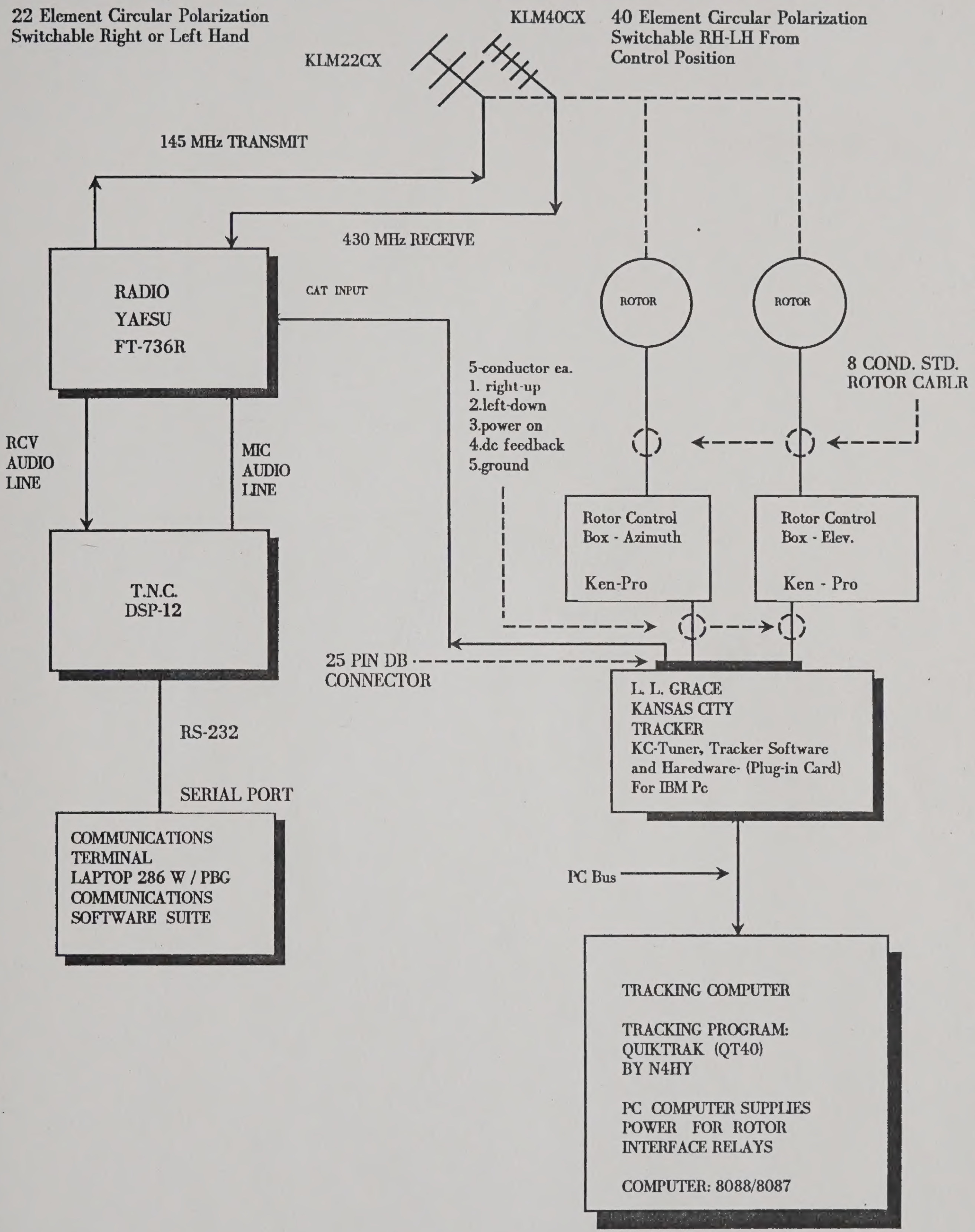
COMMUNICATIONS SOFTWARE

Required to Work the Microsats



FPLEHD.GL

COMMUNICATIONS HARDWARE AT K6IVY FOR MICROSAT(S)* AO-16, LO-19 & FO-20**



THE TRACKING COMPUTER PROVIDES ALL NECESSARY INFORMATION ABOUT SATELLITE LOCATION. PRINTED OUTPUT IS VERY HELPFUL. TRACKING COMPUTER ALSO STEERS THE ANTENNAS AND TUNES THE RADIO(S) IN REAL TIME - PARTIAL AUTOMATION

*MICROSATS REQUIRE PBG SOFTWARE SUITE .

**FO-20, FUJI (OSCAR 20) REQUIRES STANDARD T.N.C. (With PSK Modem) & COMMUNICATIONS SOFTWARE